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3. **Some Exploratory Observations of the Tensile Properties of Metals at Very Low Temperatures,** by E. T. Wessel, Westinghouse Research Laboratories.

4. **Effect of Strain Rate and Temperature on the Plastic Deformation of High-Purity Aluminum,** by T. A. Trozera, O. D. Sherby and J. E. Dorn, University of California.

5. **Effect of Subboundaries and Carbide Distribution on the Notch Toughness of an Ingot Iron,** by J. C. Danko and R. D. Stout, Lehigh University.

6. **Notch Ductility of Malleable Irons,** by G. A. Sandoz, N. C. Howells, H. F. Bishop and W. S. Pellini, Naval Research Laboratory.

7. **New Nodular Iron Process,** by H. K. Ihrig, Allis-Chalmers Manufacturing Co.

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10. **Influence of Alloying on the Elastic Modulus of Titanium Alloys,** by W. H. Graft, D. W. Levinson and W. Rostoker, Armour Research Foundation.

11. **A Study of the Air Contamination of Three Titanium Alloys,** by J. E. Reynolds, H. R. Ogden and R. I. Jaffee, Battelle Memorial Institute.

12. **Effect of Sulphur on the Properties of Titanium and Titanium Alloys,** by L. W. Berger, D. N. Williams and R. I. Jaffee, Battelle Memorial Institute.

13. **Relationship Between Heat Treatment, Structure and Mechanical Properties of a Titanium Alloy Containing 4% Cr and 2% Mo,** by A. W. Goldenstein and W. Rostoker, Armour Research Foundation.

14. **Temperability of Steels,** by L. D. Jaffe, California Institute of Technology, and Edward Gordon, United Gas Corp.

15. **Temperature Dependence of the Hardness of 'Pure' Iron and Various Ferritic Steels,** by F. Garofalo and D. C. Marsden, U. S. Steel Corp., and G. V. Smith, Cornell University.

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20. **Transformation Kinetics of Uranium-Molybdenum Alloys,** by R. J. Van Thyne and D. J. McPherson, Armour Research Foundation.

21. **Plastic Deformation of Uranium on Thermal Cycling,** by H. H. Chiswik, Argonne National Laboratory.

22. **Impact Characteristics and Mechanical Properties of Leaded and Nonleaded C-1050 and C-1141 Steels,** by A. P. Weaver, Inland Steel Co.

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26. **Precipitation Reactions in Austenitic Cr-Mn-C-N** Strength Levels, by Chi-Mei Hsiao and E. J. Dulis, Crucible Steel Co. of America.

27. **Martensitic Transformation in the Machining of Austenitic Stainless Steel,** by E. F. Erbin, Titanium Metals Corp. of America, E. R. Marshall, University of Vermont, and W. A. Backofen, Massachusetts Institute of Technology.

Jacksonville Hears Talk On Materials Problems Of Nuclear Reactors

Speaker: W. D. Manly

Oak Ridge National Laboratory

At a meeting of the **Jacksonville Chapter** held at the Parker & Mick Welding & Machine Works plant, W. D. Manly, associate director, metallurgical division, Oak Ridge National Laboratory, presented a talk on "Materials Problems in Nuclear Reactors".

Mr. Manly explained the various types of reactors and presented data on the properties of the materials that may be used in their construction and operation.

A hypothetical nuclear engine was then described and fuel, coolant, control, moderator and shielding were listed as the necessary parts of any reactor. From previously presented data, Mr. Manly selected uranium as the fuel and liquid sodium as the primary coolant, with a mixture of sodium and potassium as a secondary source to generate steam for the engine.

Control rods, which slow or accelerate the reaction and regulate the heat output of a boron carbide-iron composition, were selected. The moderator chosen was sodium hydroxide, contained in nickel. As a shield to absorb the gamma radiation, lead was chosen.

L. W. Hayden, vice-president of the Lindberg Engineering Co., gave an interesting historical picture of the growth of modern heat treating furnaces and equipment. His experience extends over many years and he was able to point out specific uses of controlled atmosphere furnaces on various heat treating processes. His talk was illustrated with a number of interesting slides showing the various types of generators used for the production of atmospheres and the various types of modern atmosphere controlled furnaces.

He also pointed out that modern heat treating furnaces, as well as high-frequency heat treating equipment, were well adapted to automation and illustrated the use of automation and high frequency in the metallizing of automotive exhaust valves.—**Reported by B. Boisvert for Jacksonville.**

Boston Chairmanship Changes Hands

Outgoing Chairman John L. Morosini (Left), Turns Over the Gavel and Bell to Incoming Chairman Harold D. Stuck Who Will Preside Over the Boston Chapter Next Season. (Photograph by H. L. Phillips for Boston)

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28. **Transformation Products in Cold-Worked Austenitic Manganese Steel,** by R. K. Buhr, and S. L. Gertsman, Department of Mines and Technical Surveys, Ottawa, and James Reekie, Northern Electric Co., Ltd. (formerly Department of Mines).

29. **Metallography of Titanium-Stabilized 18-8 Stainless Steel,** by T. V. Simpkinson, Republic Steel Corp.

30. **Phase Relationships and Mechanical Properties of Some Iron-Chromium-Carbon-Nitrogen Alloys,** G. F. Tisinai and C. H. Samans, Standard Oil Co., Whiting, Ind.

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33. **High-Temperature Rupture-Strength Properties of Chromium-Nickel Stainless Steels Containing Titanium and Boron,** by J. Salvaggi and L. A. Yerkovich, Cornell Aeronautical Laboratory, Inc.

34. **Effect of Environment on Creep-Rupture Properties of Some Commercial Alloys,** by Paul Shahinian, Naval Research Laboratory.

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37. **Some High-Temperature Oxidation Characteristics of Nickel With Chromium Additions,** by G. E. Zima, California Institute of Technology.

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44. **Phase Relationship of the Calcium-Lithium Systems,** by M. R. Wolfson, U. S. Naval Ordnance Test Station.

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Knoxville, Tenn.</td><td>W. S. Dritt
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Oak Ridge, Tenn.</td><td>Henry Inouye
105 Newberry Circle
Oak Ridge, Tenn.</td></tr>
</table>

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WORCESTER	Lincoln G. Shaw 15 South St. Auburn, Mass.	Walter J. Nartowt 12 Manor Rd. Millbury, Mass.	Ralph N. S. Merritt, Jr. Olson Manufacturing Co. 100 Prescott St. Worcester 5, Mass.	
YORK	John H. Fisher 716 Clayton Ave. Waynesboro, Pa.	Raymond F. Vines Dentists Supply Co. York, Pa.	Clarence R. Eppinger Horace T. Potts Co. 53 N. Duke St. York, Pa.	Paul D. Strubhar R.C.A. Victor Div. Lancaster, Pa.

At Milwaukee's Students Night Meeting

Shown Is a Group of Students From the University of Wisconsin, Marquette University and the University of Wisconsin's Extension Division, Who Attended the Milwaukee Chapter's Students Night Meeting. Shown, front row, from left, are: R. W. Mackinson, T. Clickalla, J. Boland, C. W. Kuchler, Jr., K. Boyd, W. Krubsack, L. Schuman and R. Limdholm. Second row, from left: D. Martin, and Professors G. Barken, P. C. Rosenthal, C. Loper, Jr., M. Evans and J. Schoen, and J. Osterle. Third row, from left: W. Rieden, E. Bache, R. Longua, A. Sherwin, A Hundhausen, R. Borgmann, J. Hinrichs, H. Schultz, H. Kraft, G. Grabow and M. Grahm. Top, from left: R. Borchardt, T. Bosshart, P. Lineham, J. Duwell, A. Basile, J. Behring, A. Meller, T. Raske, T. Banski, H. W. Mueller and J. A. Giuntoli. (Reported by D. P. Kedzie)

High-Temperature Metallurgy Topic on Pittsburgh Night

Speaker: C. T. Evans, Jr.
Universal-Cyclops Steel Corp.

The Fifth Annual Pittsburgh Night Lecture was presented to the members of the **Pittsburgh Chapter** by Charles T. Evans, Jr., vice-president, technology and development, Universal-Cyclops Steel Corp. At the close of his timely discussion, entitled "Recent Developments in High-Temperature Metallurgy", Mr. Evans was awarded a certificate acknowledging his outstanding achievements in the field of metallurgy.

One of the most notable aspects of high-temperature metallurgy in recent years has been the very rapid advancement of the technology of melting and casting the high-temperature alloys for turbine blades and similar applications. In the last three years, three new melting techniques have progressed from the development laboratory to increasing production use throughout the industry. Mr. Evans discussed the basic features of these new processes which are induction vacuum melting, consumable arc vacuum melting and vacuum degassing. Further improvements in ingot pouring practice have been achieved through the use of the Linde slag process.

The stimulus for these recent developments has been the need for an improved combination of high-temperature ductility and rupture strength and the need to reduce alloy segregation and to reduce the variation of properties within heats of high-temperature alloys.

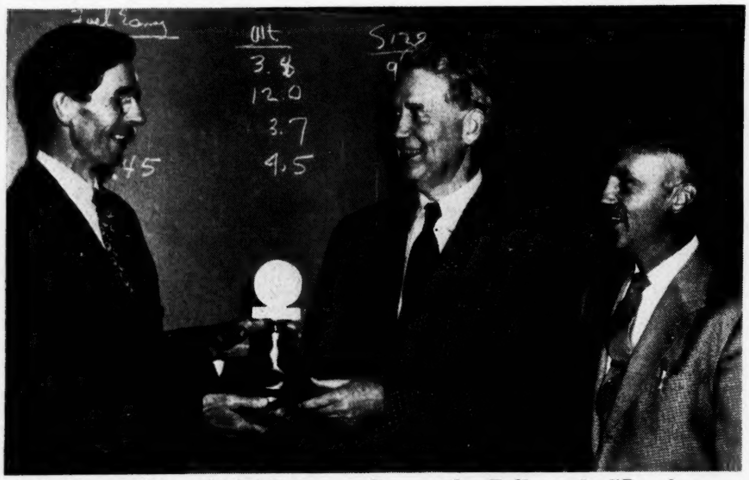
The major advantage of these new vacuum processes is the reduction of contamination which is attained by eliminating contact of the molten alloy with slag, air and/or crucible. In induction vacuum melting, contact with air and slag are eliminated while the consumable arc vacuum process effectively eliminates contact with all three because of the nearly instantaneous solidification at the water-cooled copper mold wall. The purity of feed stock materials is thus an important consideration.

Mr. Evans discussed the fundamental characteristics of these processes as compared to slag-controlled techniques. Hydrogen and oxygen concentrations are effectively reduced by the vacuum technique, but little change in nitrogen content over the conventional techniques is noted. This latter effect attests to the stability of the nitrogen compounds present. A duplex process, known as Duovac, combines the greater flexibility in raw material selection of the induction vacuum process with the improved ingot structure and cleanliness of the consumable arc vacuum process. However, increased cost is a limitation to the extensive use of this method.

That these techniques have resulted in marked improvement in alloy properties is evident from the fact that present alloys can meet specifications that have much more stringent requirements than the specifications of three years past. For example, through vacuum melting, the requirements for 1500° F. properties of turbine blade alloys have been increased from 23-hr. life at 27,500 psi. to 75-hr. life at 40,000 psi. with a minimum elongation of 10%. Further improvements have also been noted in ingot structure. Two common structural problems, peripheral inclusions and center segregation, have been reduced to some extent.

Mr. Evans concluded his talk with some interesting observations on future trends in the high-temperature metals industry. The limiting properties of the nickel, cobalt and iron-base alloys currently in use have been nearly realized and hence a need for the study of new materials is evident. Mr. Evans predicted an increasing effort on the development of the refractory metals, especially molybdenum and its alloys. His parent company is now planning the study of a closed-cycle, argon-filled fabricating plant for the processing of molybdenum ingots protected from catastrophic oxidation. **—Reported by H. W. Paxton for Pittsburgh Chapter.**

Editor Describes Automobile of Future



E. E. Thum, Editor, Metal Progress, *Presented a Talk on the "Development of the Automobile" at a Meeting Held Recently by the Los Alamos Chapter. He is shown (center) passing the Chapter bell to the new chairman, W. N. Miner, while R. T. Phelps, the outgoing chairman, stands by*

Speaker: E. E. Thum

Metal Progress

E. E. Thum, editor, *Metal Progress,* addressed members of **Los Alamos Chapter** during a recent visit to the Los Alamos Scientific Laboratory. He spoke about the "Development of Automobiles" and what changes might be looked for in five to ten years.

As background he cited various statistical information to facilitate an evaluation of the outlook. Among the many significant aspects mentioned were: The relationship between the growth of population and the number of cars on the road; the national increase in the consumption of gasoline, which is of some concern to the petroleum industry; the increase in horsepower of the modern automobile; and the rapid increase in the number of families who own two cars instead of one.

Mr. Thum pointed out that among the possibilities which appear to exist for improving automobile performance, three general approaches seem likely. The weight of cars might be reduced through increased use of the lighter metals, liquid fuels may be improved, and operational efficiency of engines may be increased. He observed that the appearance of more aluminum might be expected in interior trim, particularly the colored anodized variety of aluminum, as is already in wider use in some European cars. The increase in total gasoline consumption has stimulated a considerable effort in the petroleum industry to improve liquid fuels so that more miles can be obtained per gallon. For similar reasons improvements are being sought in engine efficiency. One engine which is receiving considerable attention at present is the gas turbine. Of considerably simpler construction and smaller than the conventional piston-type automobile engine, and capable of using lower grade fuel, it is still fraught with the inherent difficulties of providing for the exhaust of very hot gases, for speed reduction of very rapidly rotating parts, and for reduction of a high noise level.

A new type of engine which is presently receiving considerable attention, Mr. Thum went on to explain, is a unique double-acting free-piston device. Though a new design, it already has been used to considerable extent in air compressors and has proven to be workable, effective and efficient. For an automobile power plant application it can furnish its hot exhaust gases to run a gas turbine, but at much lower and more acceptable temperatures. It thus might be the key to the powering of future cars by the gas turbine.

In summary, Mr. Thum stated he felt that the family or all-purpose car of the immediate future would be somewhat lighter than at present, though not appreciably, nor would their size change much. More efficient burning of fuel and increased compression ratios could be anticipated. Preference for the conventional front location of the engine he felt would continue to prevail, and simplification of present design through elimination of the propeller shaft would lead to wider use of the front wheel drive, already well proven in military vehicles. With regard to the increasing need for a second car in the average suburban family, Mr. Thum offered the thought that future years will see this need answered by a small electric car. For short trips in low speed zone areas, its battery could be recharged nightly, and as a small, inexpensive, easily operated vehicle, it could well serve the average need for domestic transportation in connection with household shopping, small errands and the like.

The subject of the American automobile being close to the heart of every car-owner, Mr. Thum had a very attentive audience and his talk was very well received.—**Reported by Daniel J. Murphy for Los Alamos.**

Honor Past Chairman in Los Angeles

Shown at a Dinner Meeting Held Recently by the Los Angeles Chapter Are, From Left: J. Dickason, Chairman of the Program Committee; Roy E. Paine, Immediate Past Chairman; and S. R. Kallenbaugh, Past Chairman. Mr. Paine is shown as he was being presented the past-chairman's certificate

Chattanooga Hears Talk on Continuous Casting Process

Speaker: Rufus Easton
Koppers Co.

The **Chattanooga Chapter** heard Rufus Easton, metallurgist, continuous casting section, Koppers Co., speak on "Continuous Castings" at a recent technical session. Using a moving picture and slides, Mr. Easton presented a description of this relatively new method of casting.

Continuous casting, as the name implies, is a process in which molten metal is poured from the ladle into a water-cooled vertical mold, through which it moves in a continuous casting to be flame cut into sections. These sections can be rolled into usable shapes without cropping of poor quality top and bottom, as is done in conventional castings. Where in a conventional casting pour of 30 tons the rollable metal would be some 45,000 lb., in the continuous casting process, only about 500 lb. would be lost from the 30-ton pour.

Continuous casting was developed for copper, aluminum and brass, but is now used for stainless steels. The quality of casting is as good or better than conventional casting and the speed and good recovery of usable metal make it competitive to conventional casting methods.—**Reported by J. H. McMinn for Chattanooga Chapter.**

A.S.M. distributes annually through chapters and by mail to secondary school students thousands of leaflets entitled "Does Engineering Appeal to You".

Speaks at 25-Year Member Night

J. P. Clark, Jr., Philadelphia Chairman, Is Shown (Right) Presenting 25-Year Membership Certificates to John Haig, Ajax Electric Co. (Center) and J. G. Jackson, William Steell Jackson Co., at a Meeting at Which R. B. Mears, U. S. Steel Corp., Spoke on "Designing for Corrosion Resistance"

Speaker: Robert B. Mears
U. S. Steel Corp.

Robert B. Mears, director of the Applied Research Laboratory at U. S. Steel's Research Center, delivered a lecture on "Designing for Corrosion Resistance" before the **Philadelphia Chapter** on "25-Year Member Night".

The corrosion resistance of many structures can be greatly increased by consideration of several important factors while the structure is still in the design stage. Plant location, material selection, elimination of crevices and pockets, use of inhibitors and cathodic protection are all factors that might aid corrosion resistance if evaluated before the structure or piece of equipment is actually built.

In the location of a plant, a distance of only hundreds of feet might severely alter the *life* of its structural components; adverse conditions might be due to moisture-laden wind currents, salt water spray or harmful industrial atmospheres.

In order to select proper materials in design, a study must be made of all available data that relates to the particular corrosion condition expected.

The importance of this advance study is shown by the fact that the addition of increasing percentages of chromium to steel in some corrosive media might actually increase rather than retard corrosion. Often, if careful evaluation of the corrosive condition is made, over-designing with respect to corrosion resistant materials can be avoided.

The time to eliminate crevices and pockets is while a job is still in the drawing board stage. Pockets and crevices collect moisture which cannot escape, and so these areas undergo corrosion at a greater rate than areas which are exposed directly to corrosive media, but which have a chance to dry. Design for corrosion prevention should also consider the outside as well as the inside of containers holding corrosive media. All too often, the inside receives more than enough protection, while the outside is attacked and fails because of insufficient protection.

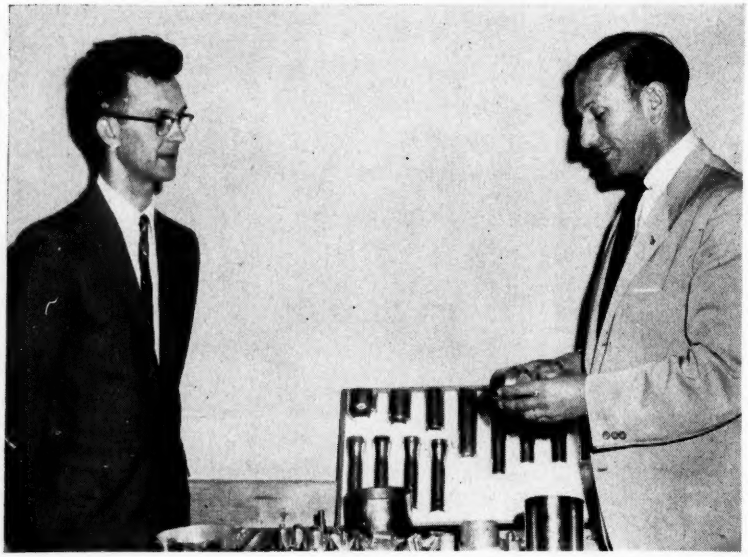
Inhibitors and cathodic protection should also be used where the conditions of operation warrant this type of protection. In order to be practical, liquids using inhibitors should be recirculated. Cathodic protection should be used where a metal is exposed to an electrolytic conductor such as a liquid or soil.

Dr. Mears effectively illustrated the influence of each design factor on corrosion by describing many actual corrosion failures.—**Reported by L. F. Calzi for Philadelphia.**

Receive Past-Chairman Certificates

Kempton H. Roll (Left), Incoming Chairman of the New York Chapter, Is Shown Presenting Past-Chairman Certificates to John P. Nielsen, Retiring Chairman, and Walter A. Stadtler, Who Was Chairman During 1954-55

Talks on Stamping and Deep Drawing



Robert D. Korten (Left), Metallurgical Engineer, Chase Brass & Copper Co., Displays Articles Described in His Talk on "Stamping and Deep Drawing" at a Meeting in Boston, to John L. Morosini, the Chapter Chairman

Speaker: R. D. Korten
Chase Brass & Copper Co.

Robert D. Korten, metallurgical engineer for the Chase Brass and Copper Co., recently spoke before the **Boston Chapter** on "Stamping and Deep Drawing".

The meeting was opened with the showing of an excellent color film on brass and copper manufacture.

Mr. Korten compared stress-strain diagrams for steel, titanium and brass. The region between the yield point and the ultimate strength indicates the deep drawing qualities of the grade in question. The average elongation for brass and copper is 60% as compared to 27% for steel and 17% for titanium. To improve directional properties, cross rolling, along with heat treatment often helps.

In drawing brass and copper, cupping is generally the first operation. The metal feeds across the die, the punch comes down and draws the metal over the die radius. This is done in a double action press. The die radius should be six times the thickness in brass. The clearance is calculated by multiplying the thickness by 2.2. This allows the metal to flow freely and prevents galling. Holding pressure must be uniform.

To determine the reduction during the drawing operation, the following formula is used:

$$\%\ \text{Reduction} = 1 - \frac{\text{die diameter}}{\text{blank diameter}}$$

In general, brass reduction will be 45%, for steel the figure will be 45-48%, and 40% for titanium (RC-70).

In redrawing, the following procedures are used for brass:

1. Cut and draw, anneal and redraw, using separate operations.
2. Cut and draw and redraw progressively with no anneals.

To obtain a heavy base and a thin wall, a so-called pinch draw is used. In most cases, an anneal is added before the pinch draw.

An eyelet machine is used for progressive drawing. It is generally limited to shallow work.

When brass is deep drawn the material is usually ordered to a 0.025 to 0.035 mm. grain size.

Process annealing of deep drawn parts presents many problems. The starting material has a uniform grain size, however, after cupping, the part has received nonuniform deformation which produces a varying grain size in the annealed part. The higher the percentage of zinc present, the greater the difficulty encountered with this nonuniform grain size. If this variation in grain size is not controlled, finishing costs will rise.

Season cracks occur in drawn parts because of nonuniform stress. A 10% mercurous nitrate solution is used as a test. If no cracks occur after 30 min. immersion, the part is passed. If the zinc content is less than 15%, season cracks generally do not occur. Stress relief annealing at 450% F. will eliminate this problem.

Several drawing procedures were described in detail, with samples of the parts in the various stages of production shown.—**Reported by William H. McCarthy for Boston.**

Science Achievement Awards Announced for 1956-57

The sixth annual program of A.S.M. Science Achievement Awards is already under way. The metals industry stands to gain much talent and technological help as a result of the stimulated interest in scientific investigations carried out by junior and senior high-school students in their program.

In the five years since the program's beginning, over 3000 youngsters have entered projects and won recognition. They will help to bolster the ranks of qualified scientists and engineers. They have identified themselves — the A.S.M. Science Achievement Awards have given them recognition.

Over 150,000 students have participated. Many of these will also contribute to our scientific and engineering manpower needs. It is reasonable to expect that many will continue their interest; that they will retain interest in their old projects or develop new ones. Many may be next year's winners.

Milwaukee Greets New Officers

New Officers for the 1956-57 Season Were Introduced at a Dinner-Dance Held by Milwaukee Chapter. Shown are, from left: M. Evans, vice-chairman; R. P. Daykin, chairman; and E. G. Guenther, secretary-treasurer

Metallurgical News and Developments

Devoted to News in the Metals Field of Special Interest to Students and Others

A Department of *Metals Review,* published by the
American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio

Recovery Method—A patented method for recovering contaminated or spent chromic acid solutions typical of chromium plating, anodizing and copper stripping operations, developed by Mutual Chemical Division of Allied Chemical & Dye Corp., is being made available for industrial use without the requirement of formal license.

Install Machine — Michigan State University's applied mechanics department has installed a universal testing machine which can squeeze or pull on building materials or structural parts with a force up to 50,000 lb.

Spectrometer—A custom-built mass spectrometer, one of a family of electronic instruments that has found wide use in the fields of science, medicine and industry in recent years, has been installed at Carboloy Department of General Electric Co. to analyze gases produced in a high-vacuum furnace in which alloys are made. The spectrometer, by literally sorting and weighing the molecular particles of the gases, can help determine and control the progress of the high-vacuum process.

New Alloys—A research program on development of new high-temperature alloys has reached the stage where two of the larger jet airplane engine manufacturers have gotten the "go ahead" signal to test the new alloys. These alloys are being developed under the auspices of the Tungsten Institute through a contract with Stanford Research Institute.

Copper Cakes—A copper shape which will enable the fabricator to produce longer sections of continuous rolled or strip copper and copper foil is being produced by the Utah Copper Division of Kennecott Copper Corp. A new $2 million vertical casting wheel makes possible the production of 40 tons per hr. of high-grade, electrolytically pure copper in "cakes" weighing 2000 lb.

Inchworm—Airborne Instruments Laboratory, Inc., has developed a new type of linear actuator that automatically feeds the work into some types of machine tools so that accuracy is assured in the range of microinches. The device, called the Inchworm, utilizes a specially formulated nickel rod for the armature of a motor. The rod shrinks as a magnetic field is created in it by a surrounding coil. A pair of clamps, cooperating with the armature, converts the expansion to a closely controlled forward movement.

New Lab to Open—The Research Laboratories of National Carbon Co. will be dedicated Sept. 18 in Parma, Ohio. The laboratory was designed primarily for basic research in chemical and solid state physics.

Flowmeter—The inertial mass flowmeter, which measures liquid or gas by weighing it continuously as it passes through a pipe, is the latest application of Ni-Span C, the "constant-modulus" alloy processed by H. A. Wilson Co. The device was developed primarily for use in jet aircraft fuel systems.

Brass Powder—A brass powder which contains nickel and phosphorus or iron nickel and phosphorus has been developed by metallurgists at New Jersey Zinc Co. and Armour Research Foundation. Gain in strength and hardness is said to bring brass powder metallurgy parts closely in line with properties of wrought metal parts.

Papers Ready—The American Society of Tool Engineers has announced availability of a complete set of coordinated technical papers on shaped diamond tools. The lectures were presented at the Industrial Diamond Symposium held in conjunction with the A.S.T.E. Convention in Chicago. Write: A.S.T.E., Shaped Diamond Tool Symposium, 10700 Puritan Ave., Detroit 38. Cost is $2 to members; $4 to nonmembers.

Tungsten Bill Passes—Bill S 3982 to provide for the maintenance of production of tungsten, asbestos, fluorspar and columbium-tantalum in the U. S. has been passed and will abolish all restrictions on the use of tungsten in jet aircraft.

Connector—A connector for joining aluminum to copper electrical conductor in severe natural environments has been developed by Kaiser Aluminum & Chemical Corp. Designated the ALCUnector, it has been found to perform satisfactorily in areas where other available connectors have failed in a relatively short time.

To Open Field—Jones & Laughlin Steel Corp. is thinking of an early entrance into the field of stainless steel, according to an announcement by Pres. C. L. Austin.

Develop Alloy—A copper-zirconium alloy possessing high electrical conductivity and good strength retention at elevated temperatures has been developed at Battelle Memorial Institute. It is suitable for electric motor commutators serving at temperatures above 500° F. and under conditions where strength is required. The alloy is the result of research for Nippert Electric Products Co.

To Up Capacity—Steel fabricating capacity will be doubled by Luria Engineering Co. when the company completes its new plant at Chicago Heights, Ill. Some of the company's output will go into an advanced type of aircraft maintenance dock for the Air Force.

Magnetic Material—Westinghouse Electric Corp. has developed a magnetic material that promises to yield more powerful new magnets than those now commercially available. Virtually 100% pure manganese-bismuth, the material has unusual resistance to demagnetization.

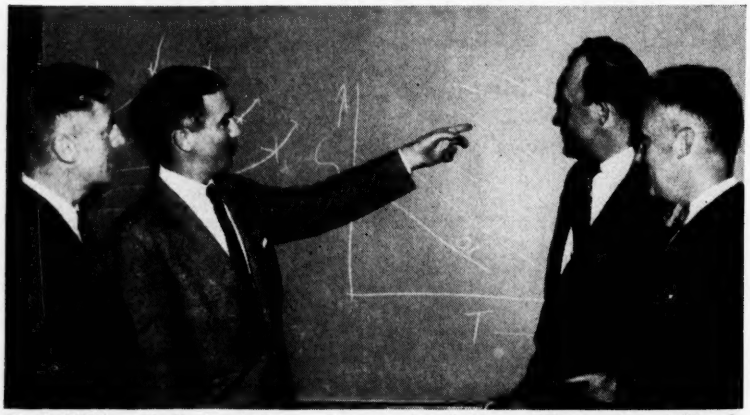
Co-Op Reactor—Armour Research Foundation's $700,000 nuclear reactor, specifically designed for industrial research, went into operation in Chicago a short time ago. As fuel, the reactor uses a water solution of approximately 1 k.g. of U^{235} on loan from A.E.C. It will be used for nuclear research by 24 companies, each of which contributed $20,000 toward the cost of construction.

Porous Electroplates—Electrochemists at Battelle Memorial Institute have developed porous electroplates of an alloy of nickel and cadmium.

Announce Contest—Steel Founders' Society of America, 606 Terminal Tower, Cleveland 13, Ohio, has announced its third Product Development Contest. Complete rules for the contest, which offers a total of $6500 in prizes, can be obtained from S.F.S.A.

Form Association—Manufacturers of resistance welding electrodes and alloys have joined forces to form a Resistance Welding Alloy Association. Headquarters are at 1900 Arch St., Philadelphia 3, Pa.

Discusses Properties of Metals



R. F. Miller, U. S. Steel Corp., Presented a Talk on "Properties of Metals at Elevated Temperatures" at a Meeting in Los Alamos. From left are: D. J. Murphy, program chairman; Dr. Miller; G. C. Hoffman, technical chairman; and R. T. Phelps, chairman. (Photo by C. O. Matthews)

Speaker: R. F. Miller
U. S. Steel Corp.

R. F. Miller, assistant to the vice-president for research and technology, U. S. Steel Corp., visited the **Los Alamos Chapter** where he talked on the "Properties of Metals at Elevated Temperatures".

Dr. Miller introduced his subject by stating that the metal wanted by an increasing number of people involved in work in this field is one which is light, strong, heat resistant, and, in fact, indestructible. Though progress toward this ideal seems imperceptibly slow, great advances have actually been made in the last 30 to 40 years, and improvements are continually being made in the metals and alloys presently available to us.

He pointed out that the two most important properties of metals at elevated temperature are strength and stability. While metals can have their strength increased by being deformed or worked at ordinary temperatures, they lose this strength if they are heated above their recrystallization temperature. It is this temperature below which increase of stress will increase the strength of a material, and above which the material will flow continuously under applied stress, as in creep. In the case of steel, the softening or recrystallization temperature is quite high, enabling its use at some of the higher service temperatures.

Dr. Miller described the creep curve and the measurement of stress to cause rupture at various elevated temperatures as primary approaches for measuring the behavior of materials for high-temperature service. He then showed typical curves to illustrate the creep behavior of various metals, including steel, and the influence of molybdenum, and molybdenum, chromium and silicon on creep at 1000° F.

He reminded the audience of available data on steels and superalloys published by the ASTM-ASME Joint Committee on Effect of Temperature on Properties of Metals. These data are useful for establishing allowable working stresses. As an example, for unfired pressure vessels these stresses are established on the basis of ¼ tensile strength, ⅝ yield strength below softening temperature, stress for creep rate of 1% per 100,000 hr., or stress for rupture in 100,000 hr. above softening temperatures.

Among the many interesting aspects of the elevated temperature field which Dr. Miller discussed were those of external stability—corrosion resistance, and internal stability—change of properties, which occur at the higher temperatures. The oxidation of plain carbon and alloy steels was described. It was pointed out that whereas metals in use at ordinary temperatures experience little change in internal structure with time, at elevated temperatures metals are actually undergoing a form of heat treatment during service. One form of structural deterioration resulting from prolonged service at elevated temperatures, that of graphitization, has come in for some special attention.

Dr. Miller then stated that recent work at the Fundamental Research Laboratory of the United States Steel Corp. has shown that the addition of aluminum to steel promotes graphitization because it combines with nitrogen to form aluminum nitride. He went on to say that nitrogen itself in steel is believed to stabilize the Fe_3C, as has been demonstrated with two 0.80% carbon steels, one with 0.001% N and the other with 0.03% N.

Dr. Miller's talk was very well illustrated with an excellent set of slides.—**Reported by Daniel J. Murphy for Los Alamos Chapter.**

New Films

U. S. Steel Corp.

The United States Steel Corp. has announced the availability of four 16-mm. sound motion pictures which should be of particular interest to groups or schools in the engineering, scientific and technical fields. The films are:

The Suspension Bridge: A colorful film on the erection of the Delaware Memorial and Paseo River bridges.

Building for the Nations: A color film on the erection of the United Nations Secretariat Building.

Speaking of Wire Rope: A technicolor film on the making of wire rope, how it is engineered and how it is used.

The Waiting Harvest: Photographed in color, covers the production of basic chemicals and their conversion to modern miracle products.

The films are loaned free of charge and are available from the Pittsburgh Film Distribution Center, U. S. Steel Advertising Division, 525 William Penn Place, Pittsburgh 30.

Chapter Night Meeting Jackson Chapter Holds

Over 120 members and guests attended the Charter Night dinner meeting of the **Jackson Chapter** in Michigan.

This Chapter, the 96th to be organized in the country, has 84 charter members, of which 18 are sustaining. The organization was welcomed to the City by Mayor Harold D. Miller and short talks were given by A. D. Wagner, chairman of the Detroit Chapter, and Robert Sweet, chairman of the West Michigan Chapter.

The Chapter's Charter was presented to John A. Richter, temporary chairman, by National President A. O. Schaefer, after which Mr. Schaefer reported on the activities of various A.S.M. Chapters. National Secretary W. H. Eisenman spoke on the future of the A.S.M. They did such an excellent job of selling the A.S.M. that 10 additional members were signed up at the meeting.

Other temporary officers in the Chapter are Glenn E. Berry, secretary-treasurer, Charles R. St. John, vice-chairman, William J. Levy, program chairman, Raymond Dhue, membership chairman, Jim McKlveen, social chairman, and Robert Ilfeld, publicity chairman.

The first organizational activity was started Jan. 28, 1956, and the rapid growth into a full-fledged Chapter is an indication of the interest shown in the American Society for Metals and the desirability of a chapter in this area.—**Reported by Charles R. St. John for Jackson.**

Rocky Mountain Chapters Tour Two Pueblo Plants

The June meeting of the **Rocky Mountain Chapter** was a joint meeting of the Pueblo and Denver groups and consisted of tours through two plants. One group visited the open-hearth, rail mill, seamless mill and coke plant department of the Colorado Fuel and Iron Corp.'s Pueblo plant, while the other group visited the Triplex Corp. to observe piston casting and machining processes.

These interesting and informative tours filled an afternoon to good advantage and were followed by a fine dinner, compliments of the Pueblo group, followed in turn by a session devoted to questions and answers pertaining to the metallurgical processes that had been observed during the day.—**Reported by V. D. Heinze for Rocky Mountain Chapter.**

Analyses Problems of Management and Engineers

Speaker: Paul J. Brouwer

Rohrer, Hibler and Replogle

At the annual Student Affairs Night, the **Cleveland Chapter** and their student guests heard Paul J. Brouwer, partner in the firm of Rohrer, Hibler and Replogle, psychological consultants to management, analyze the problems existing today between some managements and the young graduate engineer in a talk entitled "Engineers and Management—Their Mutual Problem".

The basic cause of the problem is the scarce supply of engineers and the rising demand in industry for them, a situation caused by the decrease in the birthrate in the 1930's, the increase in technological developments and the spending of more dollars for research. The law of supply and demand is so badly upset that each graduate, almost regardless of ability, may have as many as 8 to 10 offers from companies who are vieing for him upon his graduation.

Here are the psychological effects involved. On the part of some managements, a feeling of resentment arises toward the trainee by some of the old timers who compare the tough time they had getting a job in 1932 with the trainee's easy time today. Some managements say graduates are soft, complacent and lack desire to meet a challenge, that they are more interested in security, promotion and retirement at the start. Management fears the "swelled head" graduate who may not appreciate the money and cost of maintaining and training the new recruit until he becomes productive. The incoming recruit with his abnormally high starting salary also tends to upset the whole salary plan management may have in relation with its older men.

The young graduate, in turn, has his troubles. To begin with, he is beset by abnormal pictures painted by company representatives vieing for his attention to the extreme where he has great difficulty in making a proper choice. He is troubled on his new job by the negative reactions among some of the older men. If he is a better than average man, he may miss the best opportunity in the scramble.

Dr. Brouwer's solution, for both parties, is what he called the "graveyard point of view" of the whole situation, that is, viewing it as temporary and abnormal. All feelings should be tempered with humor and a broad perspective. The young graduate should ask to be valued for his true worth, forgetting the money value. He should recognize the feelings of resentment and their cause. The graduate should ask himself what he wants to be doing 10 or 20 years from now, what experience he will need, and then he should use his conclusions as a yardstick to measure his offers. Management should study itself, its philosophy, what it can offer in 10 years and the kind of personality it has.

If the young graduate is zealous and fair and the company is progressive and sensitive to the recruit's problems, the company has the best chance to satisfy the shortage and the graduate has the least chance of error in his choice.—**Reported by J. J. Glubish for Cleveland Chapter.**

Speaks on Nuclear Materials Problems

John H. Frye, Jr. (Center) Director, Metallurgy Division, Oak Ridge National Laboratory, Discussed "Materials Problems of Nuclear Energy" at the Students Night Meeting in New York. Shown left of Dr. Frye is Kempton H. Roll, chairman, and at right is Fred Stirbl, program chairman

Speaker: John H. Frye, Jr.

Oak Ridge National Laboratory

John H. Frye, director of the metallurgy division, Oak Ridge National Laboratory, presented a discussion on "Nuclear Problems of Atomic Energy" at a meeting of **New York Chapter.**

Dr. Frye pointed out that although the production of nuclear power is technically feasible, the main problem is one of reducing costs to the point where the power is economically competitive with existing sources. One of the advantages of the atomic reactor is that it constitutes a concentrated source of energy. For example, in 1 cu. yd. of space, one can easily produce 100 m.w. of heat and continue to do so for two months without replenishing the uranium being fissioned. When the fuel must be replaced, the total weight of uranium and container is of the magnitude of a ton, whereas, if coal were used, several thousand tons would be required. Thus, it was emphasized by the speaker, such reactors would be exceedingly important for power production in remote and inaccessible regions and also for the propulsion of various vehicles.

Dr. Frye further described the components of the materials testing reactor in Idaho, which has operated reliably for a number of years. He pointed out that the cost of fuel is almost entirely dependent on the cost of metallurgical fabrication and chemical processing. Therefore, as soon as the metallurgists and chemists can reduce these costs to very low levels, nuclear fuel will replace coal for the production of electrical power in the United States. Dr. Frye also indicated that, with a thermal efficiency of 25% and a breeding system, nuclear power should be competitive with coal power in the United States.—**Reported by Fred Stirbl for New York Chapter.**

25-Year Member Receives Certificate

Paul Ogden (Left), Retiring Chairman of the Tulsa Chapter, Is Shown Presenting a Silver Certificate in Recognition of a Quarter of a Century's Service to A. S. M. to J. C. Holmberg. Mr. Holmberg first became affiliated with A. S. M. in Pittsburgh in 1929. Since that time he has occupied various offices, including that of chairman of the Tulsa Chapter, and has just concluded three years of service as a member of the National Advisory Education Committee. (Reported by Ferris A. Dewey for Tulsa Chapter)

Metallurgical Aspects of Machinability Presented At Meeting Held in Quebec

Speaker: F. W. Boulger
Battelle Memorial Institute

At a meeting of the **Quebec Chapter**, Francis W. Boulger, chief of the division of ferrous metallurgy, Battelle Memorial Institute, gave a lecture on the "Metallurgical Aspects of Machinability".

Mr. Boulger defined good machinability as the property in a metal enabling it to be processed in a machine shop without antagonizing the machinist. The property depends essentially on the tendencies of the metal to heat and abrade the tool during chip removal. There is a poor relationship between machinability and hardness and other mechanical properties because the conditions as regards rate of strain and temperature at the instant of chip removal are far removed from those in an ordinary hardness or tensile test. Different types of machining operations often rank given materials in different orders. Some form of practical and applicable machining test is the only effective criterion; one of these is the constant pressure lathe test, devised at Battelle, in which the tool is fed into the workpiece by a constant force. Drill calorimeter tests have shown that 97 to 98% of the work done in machining appeared as heat. Temperatures at the tool face can go as high as 1700° F. Even at 1300° F., the hardness of high speed steel dropped to only about Brinell 250.

Mr. Boulger described the beneficial effects of sulphur and lead on machinability and the good results obtained by lowering the carbon and silicon content in B1113 steel, which alters the characteristics of the nonmetallic inclusions present. Improved machinability can be utilized either by increasing machining rates or by obtaining longer tool life. There is usually an optimum combination of feed and speed, and generally a heavier feed with a lower speed is best from the point of view of tool life. **—Reported by J. E. Chard for Quebec Chapter.**

Metallographs Exhibited at Chapters and Universities

The winning entries in the 1955 Metallographic Exhibit at the Philadelphia Metal Congress were sent to a total of 19 chapters and engineering schools during the past winter and spring.

Starting out at the Cincinnati Chapter, two express cases containing 11 panels of micrographs in 11 different classifications, were shipped to the University of Cincinnati, Columbus Chapter, Ohio State University, Dayton Chapter, Youngstown Chapter, Youngstown University, Chicago Chapter, Illinois Institute of Technology, Saginaw Chapter, Penn State Chapter, Penn State University, Pittsburgh Chapter, Carnegie Institute of Technology, University of Pittsburgh, Stevens Institute of Technology, University of Minnesota, University of Wisconsin, Purdue Chapter and Purdue University.

Nearly 4900 miles were covered during the 1956 schedule of travel for the exhibit; 2000 A.S.M. members, students and faculty members saw the winning photomicrographs.

Greets New Chairman at Manitoba

The Outgoing Chairman of the Manitoba Chapter, Alex W. Gerrard (Right), Is Shown Congratulating His Successor, John E. Graver. Mr. Gerrard is with Atlas Steels Ltd., and Mr. Graver with Canada Packers Ltd. The chairmanship changed hands at the Chapter's annual meeting and smorgasbord

N. E. Pennsylvania Hears Discussion on Alloy Steels

Speaker: Walter Crafts
Electro Metallurgical Co.

The **Northeastern Pennsylvania Chapter** heard Walter Crafts, associate director of research, Metals Research Laboratory, Electro Metallurgical Co., and a national trustee A.S.M., present a technical discussion on "Recent Developments in Alloy Steel".

Mr. Crafts described problems in heat treating steels, structural alloy steels for subzero and elevated temperature application, high alloy and stainless steels for service requiring creep strength and high resistance to corrosion.

Mr. Crafts also presented a discussion of the aims and future plans of the A.S.M., mentioning that the Society is not a static organization but is vigorously engaged in the promotion of its goals, which include the construction of a new headquarters building, and the development of the Metals Engineering Institute for home study courses.

Election of officers concluded this meeting.—**Reported by John Jacobs for Northeastern Pennsylvania.**

Penn State Hears Talk on Physical Metallurgy of Titanium and Its Alloys

Speaker: W. W. Wentz
Rem-Cru Titanium, Inc.

At a recent meeting of the **Penn State Chapter,** W. W. Wentz, research metallurgist, Rem-Cru Titanium, Inc., presented a talk on the "Physical Metallurgy of Titanium and Its Alloys". Mr. Wentz gave a comprehensive outline of the principal titanium alloys, their properties and behavior.

Pure titanium is allotropic. At 1620° F., it transforms from the hexagonal closed-packed (alpha) structure, which is stable at lower temperatures, to the body-centered cubic (beta) structure. Alloying elements are added to stabilize either alpha or beta or to give an alpha-plus-beta combination at room temperature.

Alloys containing only alpha stabilizers exhibit useful strength up to 1200° F., resist air contamination to 2000° F., and have good impact strength. They are not responsive to heat treatment and exhibit the least formability of the three general alloy types.

Beta alloys have good strength at elevated temperature and have good formability. At the present time, no all-beta alloys are available on a commercial scale, but Mr. Wentz pointed out that the introduction of metastable beta alloys can be expected, in due time, to become commercially available.

Alpha-beta alloys are relatively simple to produce in quantity. They have good ductility and can be forged and rolled more readily than alpha or beta alloys. They are also heat treatable. One disadvantage of the alpha-beta alloys is that they have poor weldability.

An important aspect of titanium metallurgy which has direct consequence in the fabrication of the metal is contamination by oxygen, nitrogen and hydrogen. These elements dissolve interstitially, have an embrittling effect on any of the alloys when present in large quantity, and increase the activity of the alpha-beta transition. Combatting these effects is one of the pressing production problems in focus today.

Mr. Wertz also described some of the important factors in the heat treating of titanium alloys and supplemented his talk with slides showing typical microstructures. — **Reported by Ralph Dermott for Penn State Chapter.**

A. S. M. publishes annually photographs and biographies of all graduating student members and distributes this information to some 22,000 possible employers.

Speaks on Process Controls in Texas

Guests at a Recent Meeting of the North Texas Chapter Included, From Left: William H. Eisenman, National Secretary; J. P. Fowler, Vice-Chairman; R. E. Van Deventer, Guest Speaker; Adolph O. Schaefer, National President; and Irving Comroe, Chairman of the North Texas Chapter

Speaker: R. E. Van Deventer
Alloy Engineering & Casting Co.

North Texas Chapter members heard Ralph E. Van Deventer, vice-president, material process, Alloy Engineering & Casting Co., speak on "Design Benefits From Application of Process Controls" recently.

Design advances are often hampered by inadequate understanding of the effects which metal producing and forming processes may have on the properties of components. Properties may be drastically altered by process factors substantially ignored by conventional handbook specifications and test methods. Process variables in the production of wrought and cast metals were discussed with reference to effects on properties of components.

Mr. Van Deventer stressed the necessity of getting the story across about the importance of metallurgy to the designer and fabricator of ferrous and nonferrous alloys. One of the things that is creating quite a bit of interest is high hardness heat treated steels in the aircraft industry, and that the internal dampening capacity in hardened steel is being well recognized. He mentioned that the processing of parts for fatigue properties gives higher service life and that one process of metals that is becoming increasingly important is transverse ductility.

Mr. Van Deventer also discussed critical deformation effects, cooling rates from center to surface of specimens, the concept of hardenability in nonferrous alloys, carburizing of transmission gears and the problems involved, machining structures in cast blades for jet engines, residual stress in carburized parts and internal rupture in jet rotor forgings.

The speaker also discussed ceramic gating and molds used in the last few years for casting ferrous and nonferrous alloys, and also spoke about evaluating cast parts for the aircraft industry.

A. O. Schaefer, president A.S.M. and W. H. Eisenman, secretary, were present at a luncheon given in their honor in Fort Worth which was also attended by the officers and executive committee of the North Texas Chapter.

At the evening meeting, Mr. Eisenman spoke on the "A.S.M. of Tomorrow" and discussed the progress of the Metals Engineering Institute. Mr. Schaefer spoke on the "Future of the A.S.M."—**Reported by Robert E. Hopper for North Texas.**

IMPORTANT MEETINGS
for September

Sept. 7-9—Metal Powder Association. Fall Meeting, The Homestead, Hot Springs, Va. (R. L. Ziegfeld, Secretary, M.P.A., 420 Lexington Ave., New York 17)

Sept. 11-13—American Die Casting Institute. Annual Meeting, Edgewater Beach Hotel, Chicago. (David Laine, Secretary, A.D.C.I., 366 Madison Ave., New York 17)

Sept. 19-21—Porcelain Enamel Institute. Annual Meeting, Broadmoor Hotel, Colorado Springs, Colo. (J. C. Oliver, Secretary, P.E.I., 1145 19th St., N.W., Washington 6, D. C.)

Sept. 16-21—American Chemical Society. Annual Meeting, Convention Hall, Atlantic City, N. J. (A. H. Emery, Executive Secretary, A.C.S., 1155—16th St., N.W., Washington 6, D. C.)

Sept. 16-22—American Society for Testing Materials. Pacific Area National Meeting, Hotel Statler, Los Angeles. (R. J. Painter, Executive Secretary, A.S.T.M., 1916 Race St., Philadelphia 3)

Sept. 17-21—Instrument Society of America. Annual Instrument-Automation Conference and Exhibit, Coliseum, New York City. (W. H. Kushnick, Executive Director, I.S.A., 1319 Allegheny Ave., Pittsburgh 33)

Sept. 20-21—American Hot Dip Galvanizers Association. Semi-Annual Meeting, Greenbrier, White Sulphur Springs, W. Va. (S. J. Swensson, Secretary, A.H.D.G.A., 1806 First National Bank Bldg., Pittsburgh 22)

Sept. 21—Cutting Tool Manufacturers Association. Fall Meeting, Lochmoor Club, Detroit. (M. G. Ewald, Secretary, C.T.M.A., 416 Penobscot Bldg., Detroit 26)

Sept. 24-25—Steel Founders' Society of America. Fall Meeting, Greenbrier, White Sulphur Springs, W. Va. (F. K. Donaldson, Executive Vice-President, S.F.S.A., 606 Terminal Tower, Cleveland 13)

Sept. 24-25—Material Handling Institute. Fall Meeting, Greenbrier, White Sulphur Springs, W. Va. (R. K. Hanson, Managing Director, M. H. I., 1 Gateway Center, Pittsburgh 22)

Sept. 25-27—Atomic Industrial Forum. Annual Trade Fair, Navy Pier, Chicago. (Secretary, 260 Madison Ave., New York 16)

Sept. 25-28—Association of Iron and Steel Engineers. Annual Meeting, Public Auditorium, Cleveland. (T. J. Ess, Managing Director, A.I.S.E., 1010 Empire Bldg., Pittsburgh 22)

Discusses Press Working of Metals

Technical Chairman Theodore Gela (Right), Stevens Institute of Technology, Welcomes J. Walter Gulliksen, Chase Brass & Copper Co., Who Gave a Talk on "Press Working of Sheet Metals" at a Meeting in New Jersey

Speaker: J. Walter Gulliksen
Chase Brass & Copper Co.

J. Walter Gulliksen, general manager of the Manufacturing Division of Chase Brass and Copper Co. and a vice-president and member of the board of directors of that company, presented a talk on "Press Working of Sheet Metals" at a **New Jersey Chapter** meeting.

Mr. Gulliksen first reviewed briefly historical information regarding the subject. He described the first patents related to modern drawing methods as being those obtained by J. H. Cole in the period 1868-1870 pertaining to drawing simple ferrule-shaped parts. He then referred to subsequent developments which led to the use of tools devised to blank and draw in the same operation and to the use of double-action presses.

Utilizing a typical stress-strain diagram, the speaker explained the characteristics of a metal that affect its ability to undergo deep drawing operations. Deep drawing can be applied to almost any ductile metal. Inasmuch as the working takes place within the plastic deformation range, it follows that those metals having a large spread between the yield and ultimate strengths are most easily deep drawn. The characteristics of elongation and rate of work hardening are also factors. Calculating the percentage of draw of a circle by subtracting the diameter of the drawn part from that of the original circle, then multiplying by 100 and dividing by the original circle diameter, the maximum percentage of draw generally possible on ductile metals was stated to be approximately 45%. Owing to work hardening, the percentage of draw possible becomes less with each subsequent draw. Sometimes it is necessary to use intermediate annealing or stress relieving operations to permit further drawing.

Mr. Gulliksen stressed that deep drawing does not involve simply stretching a sheet blank into shape and he illustrated this by several examples. The ideal situation is to persuade the metal to flow under control without either thinning or thickening. This means that proper radii on the punch and the die, proper clearance between the punch and die and suitable tool adjustment must be used. If adequate attention is not given to these factors, any attempt made to use tooling that results in "beating" the metal into place generally leads to difficulties.

Hydroforming was described as a process wherein the sheet metal is forced to conform to the shape desired, as incorporated in a punch, by liquid pressure exerted against a rubber pad. This was stated to have advantages related to simplicity of tooling and to lack of tendency to mar surfaces of the parts. It is somewhat slow and expensive and requires a skilled operator to develop a job, although later runs are easy to duplicate. It is not adapted to the production of some types of parts, such as those having a pointed shape or those so shaped that the punch can not be stripped therefrom.

Mr. Gulliksen included a description of the types of parts produced by the impact extrusion process and pointed out the differences in characteristics possible to obtain by this method as compared to those of regular deep drawn parts. A number of interesting examples of both deep drawn parts in several metals and impact extrusions in aluminum alloys were exhibited. These prompted an active informal discussion following the lecture.—**Reported by K. B. Baker for New Jersey.**

IN RETROSPECT

Items of interest, *Transactions,* December 1924: "M. H. MEDWEDEFF has resigned as metallurgist and superintendent of the heat treating department of the Marion Forged Products Co., Marion, Ind., to accept a position with the AC Sparkplug Co., Flint, Mich." Mr. Medwedeff is now retired and served as tour escort during the World Metallurgical Congress in 1951.

♦ ♦ ♦

Another personal mention: " O. T. MUEHLEMEYER, formerly metallurgist with Barber-Colman Co., has announced that he will establish a plant for commercial heat treating services with headquarters in Rockford, Ill." Mr. Muehlemeyer, now deceased, was the first chairman of the Rockford Chapter.

♦ ♦ ♦

The "Q-Alloys Box Bulletin" in the January 1925 issue of *Transactions* regales readers with a metallurgical crossword puzzle. Definitions range from "mother of pearl (father unknown)" to "the best alloys begin with it"—a single letter!

♦ ♦ ♦

The "Box Bulletin", edited by H. H. HARRIS, now president of General Alloys Co., was currently subsidizing six advertising pages in each issue of *Transactions* extolling the virtues of General Alloys, well larded with pungent comments on A.S.M. activities, New England, the heat treating industry in general, and observations by a character named Krit Icklepoints.

♦ ♦ ♦

During the same year E. F. Houghton and Co.'s advertising took the form of "Heart to Heart Talks With Steel Treaters" by president CHARLES E. CARPENTER (now deceased). Sample paragraph: "There are more patents on case hardening materials than there are pickles in Pittsburgh. We own some. Taken as a whole I don't think much of them. . . To have a good patent and a patent on a good material are two different things. . ."

♦ ♦ ♦

The 1925 winter sectional meeting of the society was held in Cincinnati in January with J. CULVER HARTZELL, chairman of the Cincinnati Chapter (now deceased) in charge of arrangements.

♦ ♦ ♦

A series of articles on the "Chemistry of Iron and Steel" by FRANK T. SISCO, then metallurgist, Air Service, War Department, McCook Field, Dayton, Ohio (now director of Engineering Foundation, New York) starting in the February 1925 issue was deemed worthy of editorial comment, pointing out that the series was in keeping with the endeavor of *Transactions* to provide articles dealing with the fundamentals as well as the advances in the art of metallurgy.

Explosive Loading Factors Explained

R. L. Getz (Right), Technical Chairman, Milwaukee Chapter, Is Shown With John Pearson, Head, Warhead Research Branch, U. S. Naval Ordnance Test Station, Who Spoke on "Fracture of Metals Under Explosive Loads"

Speaker: John Pearson

U. S. N. Ordnance Test Station

John Pearson, head, Warhead Research Branch, U. S. Naval Ordnance Test Station, China Lake, Calif., discussed "Fracturing of Metals Under Explosive Loads" at a meeting held by the **Milwaukee Chapter.**

Impulsive loading differs from conventional loading in that it causes severe plastic deformation in less than one microsecond, can produce compressive stresses up to 4 million psi. and can cause a 30% increase in density.

Under impulsive loading, the stress and strain are not uniformly distributed as they are in conventional loading. This increases the tensile, yield and fracture strengths and brings into prominence other properties such as density, the delay time for plastic deformation and so forth.

The explosive used in this work is a plastic of putty-like consistency named "C-3". It can be rolled, flattened or deformed in any way without danger.

Four types of loading are used: I. A disk having a concentrated charge placed on one or both faces. II. A cylinder having a charge in the center. III. A rod or tube having the charge placed around the outer periphery. IV. A sandwich-type with the metal placed between two layers of explosives.

Type I loading exhibits a somewhat semicircular depression on the surfaces the charge is placed on, tension cracks through the center section and scabbing or spalling on the opposite face. The extent of damage depends on rolling direction (rolling direction normal to load most advantageous), the initial hardness, the loading temperatures and the size of the charge.

Type II produces tangential shear cracks around the hole and radial tension cracks some distance from the hole. The distance the tension cracks begin away from the hole depends on the material and the size of the charge. The number of tension cracks depends on the critical impact velocity of the material. The typical cone-shaped piece that is removed from the end opposite the igniter is a result of the interaction of the release pressures traveling toward the center from the ends. The included angle of the cone is a function of the material and varies between 60 and 90°.

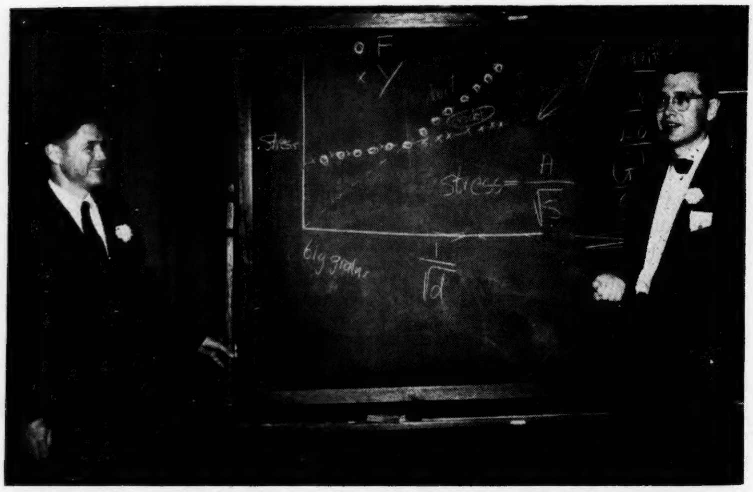
Type III loading causes the cylinder to fail in strips of varying widths, with the axis parallel to the length of the cylinder. Under the high compressive loads (4×10^6 psi.), the tube is compressed, as evidenced by the fact that the tube wall is thicker after the test than before, but due to the extremely rapid rate of unloading, the tube fails in tension, hence, the strips.

Type IV loading, a sandwich type, will cause a plate to split parallel to its faces due to the interaction of reflected compressive waves emanating from each face.

A short discussion period followed the presentation and concerned the differences between propellants and explosives and the merits of an autofrettaged versus a solid tube under impulsive loading.—**Reported by Donald P. Kedzie for Milwaukee.**

A.S.M. has not increased its dues ($10.00 per year) since it was founded.

Old-Timers Hear Talk on Fracture



John C. Fisher (Right), General Electric Co. Research Laboratory, Spoke on "Brittle Fracture of Metals" at Detroit Chapter's Old-Timers Night Meeting Held Recently. At left is G. A. Timmons, technical chairman

Speaker: John C. Fisher
General Electric Co.

Members of the **Detroit Chapter** feted "Old Timers" and 25-year certificates were awarded to R. A. Clark, H. T. Cousins, W. F. Herdrich, and J. E. Spittle at a meeting held recently.

"Old Timer" H. L. (Herb) Shippy, who gave the coffee talk, reminded all present of the tools and instruments available to metallurgists and heat treaters in the era prior to World War I, and cited the accomplishments of the metallurgists of that era.

John C. Fisher, manager, physical metallurgy section, metallurgy and ceramics research department, research laboratory, General Electric Co., presented a talk on "Brittle Fracture of Metals". Dr. Fisher reviewed the research on the subject in a delightfully informal manner, and in terms all could understand.

Reminding his listeners that we use metals not because they are strong, but because they are ductile, Dr. Fisher emphasized the importance of the ability of metals to relieve localized over-stressing. Engineering materials must be able to withstand abuse.

In discussing the causes of brittle fracture, Dr. Fisher first cited the work of Griffith, in the 1920's, who studied glass, and attributed strength to surface tension—the energy required to create new surfaces.

Griffith showed a definite relationship between critical fracture stress and the size of a crack. Observations by Orowan, in the 1940's, and later by Low and Gilman, showed that Griffith's formula did not seem to satisfactorily account for the energy which is required to fracture metal.

Dr. Fisher explained that fracture of metals involved both surface energy and the energy of plastic deformation.

Dr. Fisher then described experiments in which polished specimens of pure iron, varying in grain size, were subjected to bending loads while the surfaces were observed under the microscope. Under the strain rate and temperature conditions of the experiment, the coarse-grained iron fractured with no slip, while the fine-grained iron exhibited both slip and cracked grains prior to fracture. From this, Dr. Fisher concluded that plastic deformation precedes crack propagation, and there must be sufficient energy present for *both* plastic deformation *and* crack propagation before fracture can occur. Brittle fracture occurs under conditions in which the stress to cause plastic deformation approaches the stress to propagate cracks, and both actions occur almost simultaneously. This condition is more easily achieved in coarse-grained metals. Dr. Fisher attributed the strength and ductility of tempered martensite to the extremely fine grain size of the structure.

Having established that cracks must precede fracture, Dr. Fisher then tackled the question: "Where do cracks come from?" He reviewed some of the proposed theories, but told his audience that he was not satisfied that anyone had a complete answer to this question. He referred to the work of Petsch on grain boundary interference with slip, and to recent experiments with single crystals and with "whiskers", and one gained the impression that cracks might be "built-in" as imperfections of one sort or another—microscopic or submicroscopic.

In the question period which followed his talk, Dr. Fisher discussed the relation of dislocations to cracks and plastic deformation, and gave some of his analogies of dislocations which helped his audience to understand the concept.—**Reported by Douglas V. Doane for the Detroit Chapter.**

Navy Schedules Symposium

The Office of Naval Research has organized a "Symposium on Molybdenum" for Sept. 18 and 19 at the Rackham Memorial Building in Detroit.

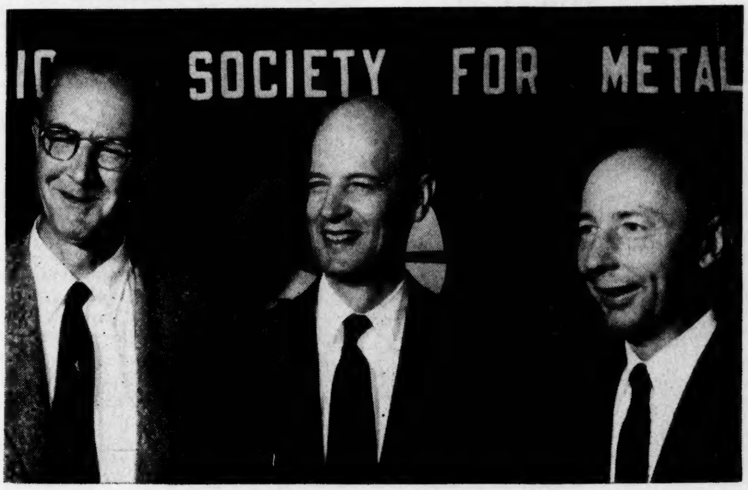
Sessions will be held on Molybdenum as a Structural Material, Preparation and Properties of Molybdenum-Base Alloys, Fabrication, and Applications in Gas Turbines.

Since the seating capacity of the hall is limited, entrance tickets will be required. Those interested should write Julius J. Harwood, Head, Metallurgy Branch, Office of Naval Research, Washington 25, D. C.

Science Awards Made in Philadelphia

Harry Ghenn, Secretary, Philadelphia Chapter, Is Shown Presenting Certificates and U. S. Savings Bonds to 1955 Winners of A.S.M. Science Achievement Awards. Shown, from left: Nancy Kuhn, Ann Marie Stolz, Arlene Laverty, Mr. Ghenn, Joy Luff, Dorothy McKenna and Mary Wiest. The girls are students at Notre Dame High School, Maylon-Rose Valley, Pa.

Presents Talk on Nuclear Reactors



Shown at a Meeting Held by the Los Angeles Chapter Are, From Left: Edgar Brooker, Past Chairman; John P. Howe, Chief, Reactor Material Section, Atomics International, North American Aviation, Guest Speaker; and Roy E. Paine, Chairman of the Chapter. Dr. Howe presented a talk entitled "Nuclear Reactors and Related Materials and Processes Problems"

Speaker: John P. Howe
North American Aviation

At a meeting of the **Los Angeles Chapter,** John P. Howe, section chief of reactor materials for Atomics International, North American Aviation, discussed "Nuclear Reactors and Related Materials, Processes, and Physical Metallurgy Problems".

Dividing the material into three sections, Dr. Howe presented a review of atomic power plants, materials and processes, and physical metallurgy problems in nuclear reactors.

Each basic type of reactor was reviewed, including pressurized water, boiling water, sodium graphite, fast breeder, homogeneous aqueous, liquid metal, liquid metal fuel and gas cooled. Dr. Howe described the fuel system, moderator, method of heat transfer, container, method of pumping the coolant and specific problems of each type.

The British and the European countries are working with the gas-cooled type of reactor, Dr. Howe pointed out, and the Russians are using a pressurized water reactor which is similar to a reactor being developed in this country.

Illustrating his talk with charts, the speaker compared the inlet and outlet temperatures of the cooling medium of the various reactors. Because of the differences of temperatures found in the fuel rod and the varying temperatures of the inlet and outlet of the coolant, various problems are encountered in the component parts including the fuel, fuel element coatings and coolants, and in the control elements.

One of the problems in the use of uranium as a base fuel is the cycling of the uranium through the transformation temperature. An increase in volume accompanying the alpha-beta transformation of over 1% creates large stresses and strains in the material. All specimens are cycled 200 times.

This cycling through the transformation temperature causes deterioration of the uranium, presenting a problem of trying to control the temperature variable within the uranium base fuel elements to avoid cycling through the transformation temperature which results in deterioration.

Severe corrosion problems will be the net result if purity of the element and the coolant are not controlled. Both the temperatures and materials are affected by these factors. To prevent corrosion of the uranium fuel elements, they are usually encased in a sheath of aluminum, zirconium or stainless steel, depending upon the temperatures achieved. In addition, it was found that particles of nickel on the aluminum reduce corrosion.

In water cooled systems, neutrons will dissociate water into hydrogen and oxygen, posing a problem in low-pressure systems where it may result in a definite explosion hazard. There is no breakdown of the sodium by bombardment with neutrons.

The effects of neutron bombardment on materials has been studied by measuring the change of electrical resistivity when measured at the temperature of liquid helium. Mechanical properties and internal friction are changed irradiation, and a reduction of ductility has been noted in some ferrous materials. Irradiation also raises the transition temperature and lowers impact strength.

The processing of nuclear fuels starts with ores, and includes reduction to metal, fabrication of fuel elements, including coating and their irradiation in a reactor, and finally of disposal of fission products and recovery of unburned fuel.—**Reported by E. T. Bergquist for Los Angeles.**

Describes High-Density Powdered Metal Parts

Speaker: W. J. Doekler
Globe Industries, Inc.

At a recent meeting held by the **Indianapolis Chapter,** W. J. Doekler, chief metallurgist, Super-Met Division, Globe Industries, Inc., presented a talk on "High-Density Powdered Metal Parts, Their Characteristics, Processing and Application".

The art of manufacturing powdered metal parts is very old. It is an art because each part has its own characteristics. The modern powdered metal fabrication of parts began in the 1930's when oil-less bearings were the principal product, although these products were of low density and their usage was limited. The goal of the iron powdered metal industry was to find a method of producing powdered metal products which would be equal in every way to fabricated iron products.

Mr. Doekler presented several charts and graphs illustrating the chemistry and physical properties of several grades of high-density iron powders. He pointed out that the best physical properties were obtained after pressing, coining and resintering.

To heat treat iron powdered metal parts, carbon must be added as pure iron will not harden, and the most satisfactory way to add carbon is by carburizing. In the manufacture of powdered metal parts, close tolerances can be maintained without difficulty.

Once the tooling has been set up, parts are extremely repetitive. Tooling is vitally important, and high accuracy can be maintained by the use of carbide dies.

High-density powdered metal parts are expensive due to the high cost of materials and tooling. If low-density powdered metal parts are satisfactory for a particular job, it is best to use them for economic reasons.

Some advantages of high-density powdered metal parts are its excellent surface finish, long life, accuracy, lower noise level of parts and ease of meeting special requirements in the design of parts. Some of their applications include gears, cams, motor inserts and electric cores.—**Reported by Dorothy Holbrook for Indianapolis.**

A.S.M. is the largest publisher of books for the metals industry in the world.

Cites Use of Radioactive Isotopes

Technical Chairman N. P. Milano (Right) Congratulates J. D. Graham, Chief Engineer, International Harvester Co., Following His Talk on "Industrial Applications of Radioactive Isotopes" at a Milwaukee Meeting

Speaker: J. D. Graham
International Harvester Co.

J. D. Graham, chief engineer, International Harvester Co., presented a talk entitled "Industrial Applications of Radioactive Isotopes" at a meeting held in **Milwaukee.**

The fundamentals of nucleonics, covering the composition of matter, the electrical charge associated with the proton, neutron and electron, the relative sizes of the components and the distribution within the atom, were discussed.

Radioactivity, with its affiliation of charge-to-mass ratio, was shown by means of slides. The three forms of radiation, alpha, beta and gamma, were described as follows: 1. Alpha is the heaviest. It consists of two neutrons and two protons but has very little penetrating power. 2. Beta is an electron which has been dislodged from its orbit. It has more penetrating power than the alpha particle, but it too can be easily stopped. 3. The gamma is electromagnetic radiation. It originates in the nucleus due to an unbalanced mass-to-electron ratio and has the greatest penetrating power.

The life of these radioactive isotopes is rated in terms of half-life, the time required for half of the radiation to decay. It is statistical in nature and invariant; therefore, it is a good measuring device.

The Geiger counter, an instrument used to measure the intensity of radiation, was described as having a neutron emitter which, when activated by the radioactivity, ionizes the gas in a sealed cylinder, causing current to flow. This is coupled to a calibrated meter or buzzer. The sensitivity can be adjusted to measure various levels of radiation. It can also be used as a leak detector, thickness gage, as a means of measuring wear, etc.

Mr. Graham stressed the importance of safety when working with radioactive isotopes, citing his company's program and the excellent record of the A.E.C.—**Reported by Donald P. Kedzie for Milwaukee.**

Compliments

To RICHARD REIN, who has received an $1800 fellowship to the Nathanial Lord School of Ohio State University. Richard graduated this year from Youngstown University with a B.S. in metallurgical engineering. He is a member of a student group A.S.M.

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To ALBERT P. SPOONER, a 1912 graduate of Lehigh University, on being presented the Alumni Association Award, which is presented to individuals "who, through the years have distinguished themselves both by personal achievement and service so as to bring lasting recognition and credit to themselves and to Lehigh University." Mr. Spooner is a metallurgical engineer for Bethlehem Steel Co. The presentation was made by Ralph L. Wilson, president of Lehigh University Alumni Association and a past president A.S.M.

♦ ♦ ♦

To WILLIAM LAVILLA FINK, chief, physical metallurgy division, Aluminum Co. of America, Aluminum Research Laboratories, who received A.S.T.M.'s Award of Merit for his work in the field of metallography; to BRUCE W. GONSER, assistant director, Battelle Memorial Institute, who received an Award for his leadership in standardization and research work; to ROLAND P. KOEHRING, section engineer for research and development, Moraine Products Division, General Motors Corp., on receiving an Award for leadership and support of standards and research work on metal powders; and to VINCENT T. MALCOLM, consultant and advisory engineer, Chapman Valve Manufacturing Co., who received the Award for his work in the fields of ferrous and nonferrous metals and for work on the effects of temperature of metals.

♦ ♦ ♦

To ALBERT EASTON WHITE, consulting metallurgical engineer, and retired director, Engineering Research Institute, and professor of metallurgical engineering, University of Michigan, on being elected to an Honorary Membership in A.S.T.M. for his widely recognized eminence in the field of work covered by the A.S.T.M. Dr. White was the first national president A.S.M. (1920.)

♦ ♦ ♦

To JAMES T. MACKENZIE, retired technical director, American Cast Iron Pipe Co., and now associated with the Southern Research Institute, on being presented with an Honorary Membership in A.S.T.M. He is a past national trustee A.S.M.

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To EDGAR C. BAIN, on his appointment as assistant executive vice-president of operations; to J. B. AUSTIN, on his appointment as vice-president, fundamental research; and to M. W. LIGHTNER, on his appointment to vice-president, applied research, U. S. Steel Corp. Dr. Bain was president A.S.M. in 1937, received the A.S.M. Gold Medal in 1949 and delivered the Campbell Memorial Lecture in 1932. Dr. Austin was president A.S.M. in 1954. Mr. Lightner is past chairman of the Pittsburgh Chapter.

♦ ♦ ♦

To HORACE POPS, a junior majoring in metallurgical engineering at Rensselaer Polytechnic Institute, who has been announced as winner of the $500 Metal Powder Association scholarship. Mr. Pops is a member of the R.P.I. Chapter A.S.M.

♦ ♦ ♦

To WALTON S. SMITH, on his retirement after 37 years of service with Metal & Thermit Corp., most recently as head of the company's manufacturing operations. Mr. Smith is a member of the New York Chapter.

♦ ♦ ♦

To ROBERT D. STOUT, who has been named head of the department of metallurgical engineering at Lehigh University, succeeding Allison Butts, who will devote full time to teaching, research and writing. Dr. Stout was presented the $2000 award from A.S.M. in 1952 for his outstanding contributions to the teaching of metallurgical engineering.

♦ ♦ ♦

To KEMPTON H. ROLL, on his appointment as the first full-time executive secretary and treasurer of the Metal Powder Association. Mr. Roll is currently chairman of the New York Chapter.

Metallurgical Research Methods Discussed at Meeting in Baltimore

Speaker: W. L. Fink
Aluminum Co. of America

"Metallurgical Research Methods" was the subject of a talk given by W. L. Fink, chief, physical metallurgy division, Aluminum Co. of America, before a meeting of the **Baltimore Chapter.**

Mr. Fink reviewed the methods used at Alcoa's research laboratory to explore new and improved aluminum alloys as well as new and improved fabricating procedures.

In a discussion of phases of an investigation, the importance of proper specimen preparation was stressed. The induction melting and laboratory heat treating facilities were cited. The same laboratory furnace may be used for all types of heat treatments in working with aluminum alloys.

The quickest and easiest method of determining structural or phase changes is by means of thermal analysis. Through the use of time-temperature charts, a study is made of heating and cooling curves. Failure to obtain equilibrium and the danger of undercooling were cited as disadvantages of thermal analysis, but methods have been developed to overcome such problems.

A new method of studying solid-liquid phases has been developed by L. A. Willey at Alcoa—equilibrium between the solid and liquid is established at any temperature for the study. By means of filtration it is possible to separate the liquid from the solid for analysis, thereby determining the eutectic concentration in some aluminum alloy systems. The use of electrical resistivity measurements to determine structural changes was also explained. The solubility of zinc in aluminum at different temperatures was cited as an example of the value realized with such methods.

The use of the interferometer to measure phase changes as well as the expansion and contraction of aluminum alloys with heating was explained by Mr. Fink.

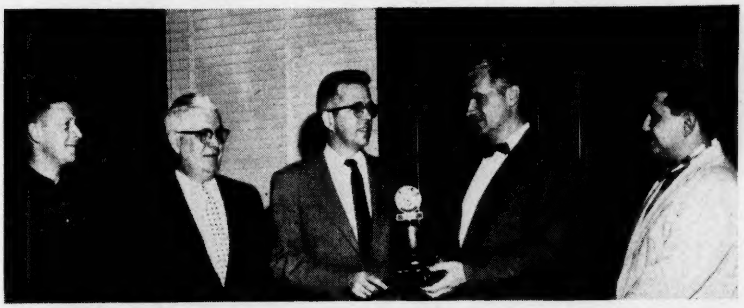
The importance of the microscope as a useful tool was illustrated by its use in examining the structure of quenched specimens to determine when equilibrium is reached after varied times at different temperatures. Another valued use is for the purpose of identifying the diffusion layers.

The determination or identification of phases in aluminum alloy systems is best accomplished by means of the X-ray powder diffraction method. Another application of the X-ray diffraction method is the determination of preferred orientations. Slides were shown to illustrate various orientations as revealed by X-ray. Degree of the crystallization is also revealed by X-ray methods.

Ultrasonic methods to locate and discard unsound material were mentioned and a slide illustrating the immersion method of sonic-testing was shown.

Some other methods cited were corrosion and tensile testing, the electron microscope, measurement of thermal emf's and microradiographs. **—Reported by J. S. White for Baltimore Chapter.**

Columbus Elects 1956-57 Officers



Newly Elected Officers of the Columbus Chapter for the Coming Season Include, From Left: Gerald K. Wood, Assistant Metallurgist, Columbus Bolt & Forging Co., Vice-Chairman; R. E. (Ernie) Christin, Co-Owner, Electric Heat Treating Co., Secretary for the 20th Year; F. W. Boulger, Chief, Division of Ferrous Metallurgy, Battelle Memorial Institute, Chairman; J. Harry Jackson, Battelle Memorial Institute, Past Chairman; and Thomas L. Chase, Co-Owner of the Electric Heat Treating Co., Treasurer. (Photograph by R. E. Christin for Columbus)

Outlines Progress and Problems in Stainless Steels at Cleveland

Speaker: Paul Nelson
Budd Co.

"Progress and Problems in Stainless Steels" were discussed by Paul Nelson, Budd Co., at a meeting of the **Cleveland Chapter.**

In a review of the research conducted in the last 25 years, Mr. Nelson humorously, yet factually, said that practically every element has been tried as an addition in stainless. Through these efforts, however, some of the old problems that plagued early users of stainless have been brought under control. The old carbide precipitation problem on welding led to the development of the stabilized grades and the ELC's. The pit corrosion problem led to the development of the use of molybdenum in grades such as 316 and 317. The free machining grades were developed by the addition of sulphur and selenium. Formability has been improved by the cleaner steels of today and the use of high nickel in a free spinning, low rate of work hardening grade.

Some of the other developments of the last 25 years have been in the many welding methods discovered. Pickling has been improved. Some recent new grades of stainless developed are those that will precipitation harden. Mr. Nelson described in detail two of these, 17-7 PH and AM 350, and discussed their treatments.

Today's problem is that of the nickel shortage. Low nickel alloys well worth consideration are the two new A.I.S.I. Types 201 and 202 and chromium manganese high nitrogen steels. The main difficulty in producing the nickel-free grades is in hot rolling. With improper analysis balance, delta ferrite is present at hot rolling temperatures and causes difficulty.

The speaker then went on to describe the use of nitrogen to stabilize the austenite. Mr. Nelson made a comparison of the properties of these low nickel grades with Types 301 and 302. It has been found that although 201 shows poorer results on some accelerated laboratory corrosion tests, it shows better than 301 in others.

Both 201 and 202 possess adequate corrosion resistance in atmospheric environments and in many corrosive media where Types 301 and 302 are now used.

There are other properties where 201 and 202 are actually proving superior. The speaker concluded that there is a lot more to learn about these alternates and they may well find their own place someday.

Tomorrow's future shows a great possibility of developing a completely austenitic stainless with no nickel at all, Mr. Nelson predicted. He also predicted more work being done in the precipitation hardening alloys.

The speaker concluded his talk by showing the use of stainless in Budd Co. railroad cars and trailers.**—Reported by J. J. Glubish for Cleveland.**

Students Visit Chicago-Western's Metallurgy Forum

Students Who Attended the First High-School Metallurgy Forum Organized by the Chicago-Western Chapter Proved the Value of the Forum by Their Great Interest. Above, at left: H. F. Graff, chief metallurgist at Arnold Engineering, demonstrates the effect of a strong magnetic field on the behavior of a metal coin for a group of the students. At right: W. O. Dow, Jr., electrometallurgist, Sunbeam Corp., explains the electroplating exhibit to a group of the students, while R. W. Hanzel, plant metallurgist, Sunbeam Corp., and secretary-treasurer of the Chicago-Western Chapter, (second from right) looks on attentively. Approximately 200 students from six suburban high schools attended the lecture and visited the ten exhibits which were contributed through the efforts of 23 companies in the area

Approximately a year ago the group of metallurgists meeting in the western suburbs of Chicago, who were recently granted a charter as the Chicago-Western Chapter, became conscious of the fact that they did not have a student affairs committee. Realizing that the work of such a committee should be a very important activity of each chapter, they asked Fred Kisslinger, associate professor of metallurgy at Illinois Institute of Technology, to organize a committee and do something in this area. One of the results of this action was the first High-School Metallurgy Forum, held on May 9, which was attended by approximately 200 students from six suburban high schools.

The purpose of the Forum was to help the high-school student obtain a picture of metallurgy so that he could consider it as a career. The program consisted of a lecture by William G. Lindner, Vanadium-Alloys Steel Co., and a series of 10 exhibits made up by 23 companies, most of which are located within the territory served by the Chapter. Exhibits were manned by 20 metallurgists who were kept very busy for several hours explaining metallurgy to an enthusiastic group of high-school students.

In his talk, Mr. Lindner explained the profession of metallurgy and discussed other points which would be of interest to a high-school student, such as the desirability of a degree in metallurgical engineering, the opportunities for research and development in the profession and the fact that the progress and welfare of all mankind depends on this work. At the present time the small number of metallurgical engineers graduating from our colleges has created a situation in which there are at least two jobs for each graduate and starting salaries for metallurgists are among the highest of all engineers. He also pointed out that engineers are acquiring top managerial positions in modern industry and, consequently, the opportunities for advancement are excellent.

After the lecture the students were served soda pop as they moved from one exhibit to the next. Each exhibit was intended to illustrate one phase of metallurgy rather than the operations of one company. Extractive metallurgy, casting, forging, heat treating, powder metallurgy, plating and corrosion, welding and brazing, reactor metallurgy, properties of magnetic materials and metallography were on display at the Forum. The students showed a surprising amount of interest in these exhibits.

A High-School Metallurgy Forum is planned as an annual event by the Chicago-Western Chapter. All the high schools in the area are to be invited in the future rather than a selected few as was the case this year.

The interest and cooperation of the schools in encouraging their students to attend, and of the various companies in supplying exhibits and of the A.S.M. members in participating in such a program to insure its success, demonstrates in a convincing manner that every professional society should consider this type of activity, assisting young people in choosing a career, as one of its more important functions.

At Southern Metals Conference Meeting

Present at an Informal Get-Acquainted Meeting Held During the Southern Metals Conference Were, From Left: National President A. O. Schaefer; Al Fairchild; National Secretary W. H. Eisenman; Howard Blackwood; Bill Tiffin, Who Was One of the Technical Speakers; and Bob Raudebaugh

The 1956 Southern Metals Conference was held at the Hotel Robert E. Lee in Winston-Salem, N. C., with the Carolinas Chapter acting as host to the Birmingham, Chattanooga, Georgia (Atlanta), Jacksonville, New Orleans, Oak Ridge, Old South and Savannah River Chapters. The student chapters from Virginia Polytechnic Institute and Southern Technical Institute were also invited.

The Conference was keynoted by W. H. Eisenman, national executive secretary, who held a chapter officers' orientation breakfast. The morning was spent by the officers of all chapters in a round table discussion on how to improve meetings and how to better serve membership.

Technical sessions were held in the afternoon under the technical chairmanship of Al Fairchild, a past-chairman of the Carolinas Chapter. Each afternoon session had four technical papers, with two each furnished by Georgia, Old South, Jacksonville, New Orleans, Birmingham and Oak Ridge.

Two mornings were devoted to plant tours, the first to the R. J. Reynolds Tobacco Co., where the metal men watched the processing of Camels and Winstons, and the second tour was to the Lexington Rd. plant of Western Electric Co.'s electronic division. The second tour was conducted by one Western Electric engineer for every two guests so that the intricacies of production could be better explained.

Highlights of the Southern Metals Conference were the cocktail party on Monday night and the banquet on Tuesday, the ladies being present on both occasions. Howard Blackwood, Conference chairman and chairman of the Carolinas Chapter, was master of ceremonies. Bill Eisenman spoke on "A.S.M.'s Past, Present and Future", and President A. O. Schaefer spoke on "European Versus American Production Techniques". The banquet was followed by a dance in true southern tradition.—**Reported by J. J. Hairston.**

Short Course in Corrosion To Be Held at Ohio State University in September

A short course in "Corrosion" will be presented by the department of metallurgy, College of Engineering, Ohio State University, from Sept. 10 through 14.

The course, which is sponsored in cooperation with the National Association of Corrosion Engineers, will be conducted by well-known metallurgists in the corrosion field.

Enrollment is limited to 150. Reservations, accompanied by full fee of $35 (to be made payable to Ohio State University), should be made by Aug. 27. Arrangements for housing can be made through the University facilities.

Cites Advances in Induction Heating

Shown at a Meeting of the Chattanooga Chapter During Which H. B. Osborn, Jr., Ohio Crankshaft Co., Presented a Talk on the "Latest Developments in Induction Heating" and New Officers Were Installed Are, From Left: LeWayne Wall, Retiring Secretary; Dr. Osborn; Jack Stocker, Retiring Chairman; Julian Glasser, Chairman; John Pikciunas, Vice-Chairman; and Charles Pandelis, Secretary-Treasurer. (Photograph from J. H. McMinn)

Speaker: H. B. Osborn, Jr.
Ohio Crankshaft Co.

Members of the **Chattanooga Chapter** heard H. B. Osborn, Jr., of Ohio Crankshaft Co., speak on the "Latest Developments in Induction Heating" at a recent meeting.

Using slides to show its many applications, Dr. Osborn traced the history of induction heating, from a laboratory demonstration of the fact that alternating current in a coil will induce currents in a piece of metal inside the coil which will cause surface heating of the metal, to the large commercial applications of this principle. Ohio Crankshaft originally began the use of this method of heating to surface harden crankshafts to a shallow depth as a solution to their problems of uniform heating, close control and ability to reproduce the same conditions which gas heating and other methods had not given. After using the method, they set up a separate division to manufacture equipment for using induction heating in many industrial processes.

Since induction heating is primarily a method of obtaining a quick, evenly distributed, easily controlled depth of heating, it can be used for almost any application where heating of metal is needed. Some of the uses are hardening by heating by induction, followed by water quenching, melting, brazing, welding by induction heat and pressure and tempering. Heating jigs can be fitted to oddly shaped pieces. The piece to be heated can move through the coil or the coil move along the piece. Several coils can be used simultaneously for different temperatures. Since the coil is not in contact with the piece being heated, pressure or tension can be applied at the same time as heat. Induction coils can be quickly changed to suit the size and shape of the particular piece to be heated.

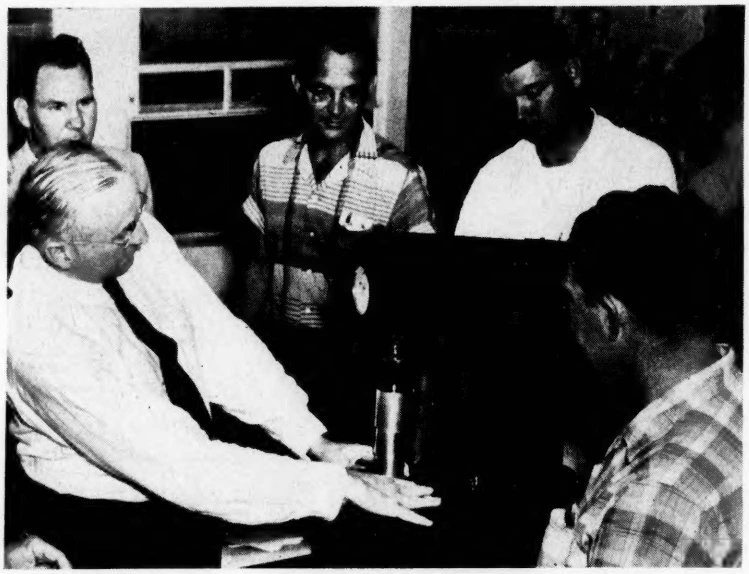
Dr. Osborn's illustrations of equipment and examples of jobs being done by induction heating gave a good picture of this method of heating which he rightfully classifies as a "machine tool".—**Reported by J. H. McMinn for Chattanooga.**

OBITUARY

L. DAVID COOK, JR., a field engineer for the Bart Manufacturing Corp., was one of the victims of the plane crash of the United Airlines and Trans-World Airlines planes on June 30 over Grand Canyon. Mr. Cook was born in DeKalb, Ill., in 1917. He received his B.S. degree in chemistry from the University of Chicago in 1940 and did graduate work in engineering and chemistry at both Illinois Institute of Technology and Wayne University. For two years he was chemist and plant engineer with the Reilly Tar and Chemical Corp. He then became chief chemist and assistant chief engineer of the Electronic Components Manufacturing of Utah Radio Products for five years. In 1947 he became associated with Wyandotte Chemicals Corp. and was with that company for seven years. In 1953 he was made manager of the Materials Engineering Group of the Research Division at Wyandotte. He became associated with Bart in 1954.

Mr. Cook, a founding member of the Detroit Section of the National Association of Corrosion Engineers, was a member of the Detroit Chapter A.S.M.

Describes Hardness Testing in Florida



Members of the Jacksonville Chapter and Students From the Jacksonville Junior College Watch a Hardness Testing Demonstration During a Recent Meeting of the Jacksonville Chapter at Which V. E. Lysaght, American Chain & Cable Co., Presented a Talk on the "Use of Hardness Testing"

Speaker: V. E. Lysaght
American Chain & Cable Co.

Vincent E. Lysaght, divisional sales manager of the Wilson Mechanical Instrument Division, American Chain & Cable Co., addressed the **Jacksonville Chapter** on the "Use of Hardness Testing" at a recent meeting. Dean Charles Eisenhart of the Jacksonville Junior College welcomed the Society and made it possible for all the engineering students to attend the meeting, which was held at the College. Representatives were also present from the University of Florida.

Basic fundamental concepts of hardness were discussed in connection with testing equipment such as Brinell, scleroscope, Knoop, Rockwell (normal and superficial), etc., and the 136° diamond pyramid hardness tester. In addition, the less-known hardness testers, including portable units, were described. The testing of sheet metals and cylindrical parts, as well as hardness-tensile conversion tables were discussed in detail. The importance of properly supporting the items to be tested, particularly irregular shapes, was emphasized. Automation in hardness testing, now carried on in industry, was outlined.

The talk was concluded with a detailed discussion of microhardness testing which is currently receiving considerable attention throughout the country.

Mr. Lysaght also presented an excellent set of slides illustrating all of the types of equipment discussed in his address, as well as the principles of hardness testing. A Rockwell hardness tester was available for demonstration. Many individual problems pertaining to hardness testing were discussed with the speaker during the question and answer period following the presentation.—**Reported by Joe Campbell for Jacksonville Chapter.**

Presents Advantages of Frozen Mercury Over Lost Wax Casting at Buffalo

Speaker: M. Gladstone
Alloy Precision Castings Co.

The frozen mercury casting process has distinct advantages and disadvantages when compared to the lost wax process. Instead of competing, these processes complement each other and, together, have expanded the field of applications of precision castings.

The little-known frozen mercury process was described to members of the **Buffalo Chapter** by Michael Gladstone, sales manager, Alloy Precision Castings Co., in a talk entitled "Frozen Mercury and Lost Wax Castings".

Since the lost wax process has been in use longer than frozen mercury and is better known, Mr. Gladstone talked chiefly on frozen mercury and how it compared to the lost wax process.

The ease with which pieces of frozen mercury can be joined is a great advantage. This is known as "booking" and is used to join pattern sections. For castings which have large internal cavities, patterns are made in halves and joined by simply placing them together. The frozen mercury fuses, making a single pattern. Made of lost wax, such pattern halves must be fused together with a hot wire. Frequently, this is not possible on the inside of the cavity, leaving a pattern defect which is transferred to the final casting.

Frozen mercury pattern die cost is higher than with the lost wax process. A 0.0005-in. tolerance on die faces must be held to prevent mercury running out of the die cavity. Furthermore, production rate is lower with frozen mercury because patterns cannot be frozen as rapidly as they can be injected of wax. Die amortization, therefore, is slower.

The handling of frozen mercury patterns presents a problem, for their own weight is sometimes sufficient to cause them to change their shape by creep. For this reason their temperature is maintained between −90 and −125°F., considerably below mercury's melting point of −38° F.—**Reported by A. E. Leach for Buffalo.**

As an indication of the tremendous dissemination of engineering information, a compilation shows that in one year the A.S.M. collected, edited, published and distributed over *one hundred million pages* **of metallurgical information.**

Past President Speaks at Meeting in Indianapolis

Members of the Indianapolis Chapter Heard a Report on "Materials Problems in the Nuclear Engineering Field" at the Last Meeting Held During the 1955-56 Season. Shown at the speakers' table are, from left: George J. Shubat, secretary; Wayne Glover, chairman; Dr. Focke; and Ed Tuttle, vice-chairman

Speaker: A. E. Focke
General Electric Co.

The final meeting of the **Indianapolis Chapter** for the 1955-56 season featured an address by A. E. Focke, past chairman of the Indianapolis Chapter and past national president A.S.M. Dr. Focke is manager, materials development, Aircraft Nuclear Propulsion Project, General Electric Co.

Dr. Focke's lecture was entitled "Materials Problems in the Nuclear Engineering Field". The principal points he discussed were:

1. Throughout the development of our civilization the success of any group has largely depended upon its ability to use the materials it has available and to develop better ones. This is particularly true in the nuclear energy industry.

2. A large percent of the total research and development funds of the Atomic Energy Commission has been and will continue to be devoted to the development of materials.

3. Throughout the entire nuclear industry, it is important to be sure that all of the materials employed in the various reactors, associated facilities and the major test equipment will perform satisfactorily mechanically, chemically and nuclearly. This last factor involves two phases—stability under radiation and the effect of the elements on the nuclear reaction or associated particles.

4. The security requirements within the nuclear industry are no more restrictive than the general limitations placed by any private industry on the retention of proprietary information in a rapidly developing new field.

5. Among the various elements that compose the earth's crust, uranium is rated 46th in abundance —about the same rating as lead and tin. U^{235} is present in normal uranium in ratio of 1 part U^{235} to 140 parts U^{238}.

6. The function of the moderator is to decrease the energy of the fission neutrons (more than two million electron volts) down to thermal energy (1/30 electron volt) where they are more easily captured by the U^{235}.

7. The Hanford production reactors employ normal uranium as the fuel, graphite as the moderator and water as the coolant. In these reactors, U^{238} captures a neutron forming U^{239}, which then decays to form Pu^{239} which is directly fissionable and can be chemically separated from U^{238}.

8. For mobile power plants, the smaller critical mass obtainable by using enriched uranium (U^{235}) is preferred. Separation of U^{235} from U^{238} is done mechanically by gaseous (UF_6) diffusion through barriers.

9. Reactors may be classed as homogeneous — fissionable material and moderator intimately mixed in solutions or slurries; and heterogenous—rigid lattices of fuel and moderator.

10. Heterogenous reactors may be further classified on the basis of coolants such as liquid metal reactors; moderators such as graphite piles or combinations.

11. Mass transfer, the selective high-temperature solution and lower temperature precipitation of elements from container walls must be considered when attempting to take advantage of the superior heat transfer characteristics and higher boiling points of liquid metals.

12. Successful commercial application of nuclear energy depends upon application of materials that will be thoroughly reliable over long periods of time and which will employ the fuel in forms that will permit economical removal of the high neutron absorbing fission fragments.

13. The Materials Test Reactor at Idaho Falls is a thermal neutron reactor having enriched uranium as fuel, ordinary water as both moderator and coolant and beryllium as the reflector. It is designed to operate at 30 megawatts with average neutron fluxes of 2 x 10^{14} thermal and 1 x 10^{14} fast neutrons per centimeter per second.

14. The general effect of high energy particle radiation of the softer metals is to raise their hardness, increase their tensile strength and lower their ductility. The effect of this radiation on metals already hardened by other means is relatively small. Thus one may conclude that the effect of this radiation is similar to that introduced by cold work.

15. High energy radiation raises the "transition temperature" of ferritic materials.

16. Most organic material will show significant property changes after irradiation to a dosage equivalent to 10^{15} fast neutrons per sq. cm. There is evidence that the effects of radiation types and intensities can be integrated to arrive at estimates of probable usefulness of organic compounds by calculation based on the energy actually absorbed in the material.—**Reported by Dorothy Holbrook for Indianapolis.**

A.S.M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad Received During the Past Month

Prepared by the Technical Information Division of Battelle Memorial Institute, Columbus, Ohio

A General Metallurgical

207-A. Will Titanium Ever Go Commercial? P. M. Unterweiser. *Iron Age,* v. 177, June 7, 1956, p. 111-116.

Titanium appears to have an established position in defense applications and a strong commercial future, high costs being the chief drawback at present. Photographs. (A4, T2, Ti)

208-A. Recovery of Zinc From Dross. A. N. Kapoor, A. B. Chatterjea and B. R. Nijhawan. *Journal of Scientific & Industrial Research,* v. 15A, sec. A, Apr. 1956, p. 179-182.

Sweating, aluminum and modified aluminum processes were examined, the latter two proving economically feasible when zinc is in short supply. Table, photograph, graph, micrographs. 6 ref. (A8, Zn)

209-A. Ventilation. J. B. Mohler. *Metal Finishing,* v. 54, June 1956, p. 77-80, 98-99.

Selection of chemicals, engineering problem, economic problem, construction materials and design of exhaust system and exhaust rates for common baths. Table, diagrams. (A7, L17)

210-A. Economic Determination of a Mining and Milling Project. James Boyd. *Mining Engineering,* v. 8, June 1956, p. 614-615.

Rate of maximum efficiency, estimation of costs, check list for the firm making foreign investments. (A4, B14)

211-A. Investment Casting Directory. *Precision Metal Molding,* v. 14, June 1956, p. 85 + 32 pages.

Specifications for 13 investment casting alloys, with product, alphabetical and trade name directories. (A10, E15, S22)

212-A. (German.) **Preparation of Work and Production Planning in a Heavy Plate Rolling Mill.** Helmut Friedrich. *Stahl und Eisen,* v. 76, no. 10, Mar. 19, 1956, p. 599-613.

Importance of the division of work within the organization. Scheduling from the reception of order to dispatch of finished products. Production reports. Rationalization of production planning and control by extended use of punched cards. Diagrams, tables. (A5, F23)

213-A. (German.) **Application of Vacuum Techniques in Metallurgical Research.** R. F. Dickerson and E. L. Foster, Jr., *Vakuum-Technik,* v. 5, no. 3, May 1956, p. 33-38.

Design, operation and use of arc, induction and other types of furnaces for heat treatment and smelting operations. Vacuum techniques can also be adapted to welding, drying and X-ray studies. Diagrams, photographs. (A general)

214-A. Steels and Their Treatment for Engineering. J. G. Ritchie. *Australasian Engineer,* v. 48, Apr. 1956, p. 57-62.

Principles underlying development of various steel types; functions of alloying elements; main types of heat treatment; methods used in metallurgical testing. (A general, J general, ST)

215-A. Process Charts for Foundry Work. F. Gaiger. *British Cast Iron Research Association, Journal of Research and Development,* v. 6, Feb. 1956, p. 142-160 + 10 plates.

Application of process chart technique in simplifying methods of production and improving efficiency. (A5, E general)

216-A. Corrosion Research Laboratories. X. Cables and Wires: BICC Research. R. L. Davies. *Corrosion Technology,* v. 3, June 1956, p. 181-184.

Activities of an industrial research laboratory working on corrosion problems. (A9, R general)

217-A. Process Control in the Plating Shop. K. E. Langford. *Electroplating and Metal Finishing,* v. 9, June 1956, p. 177-182.

Operational sequences that can be subjected to some form of control; principal methods of control; frequency of analysis, statistical control. (A5, L general)

218-A. Foundry Teaching and Research at MIT. Howard F. Taylor. *Foundry,* v. 84, July 1956, p. 74-79.

Report of equipment, facilities and curricula available for training engineers and conducting foundry research. (A3, E general)

219-A. Dust and Fume Extraction in Foundries. J. A. Wilkins. *Foundry Trade Journal,* v. 100, May 31, 1956, p. 381-387.

Methods of eliminating dust and fumes in relation to various foundry operations. (A7, E general)

220-A. Problems and Progress in Manufacture and Metallurgy. H. H. Burton. *Iron and Steel Institute, Journal,* v. 183, June 1956, p. 113-123.

Problems involved in shipbuilding, power generation and aeronautical engineering. Future developments necessary to meet engineering requirements for steel. (A general, ST)

The coding symbols at the end of the abstracts refer to the ASM-SLA Metallurgical Literature Classification. For details write to the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

221-A. Sir Henry Bessemer, 1813-1898. James Mitchell. *Iron and Steel Institute, Journal,* v. 183, June 1956, p. 179-188 + 4 plates.

The life of Bessemer, development of the Bessemer furnace and its effect on the steel industry. (A2, D3, ST)

222-A. Sir Henry Bessemer, Inventor and Businessman. Georges Delbart. *Iron and Steel Institute, Journal,* v. 183, June 1956, p. 190-195.

Bessemer's invention; steelmaking in a converter; Bessemer the man. (A2, D3, ST)

223-A. When Trouble Comes . . . Shut It Down, or Make Hot Repairs? J. S. Clarke. *Oil and Gas Journal,* v. 54, July 2, 1956, p. 90-92.

List of safe procedures for preparation steps in welding on catalytic cracking units during operation. (A7, K1, ST)

224-A. Some Metallurgical Problems Arising From Stratospheric Flight. P. L. Teed. *Shell Aviation News,* 1956, no. 215, May 1956, p. 14-21.

Problem of stratospheric flight involves evaluation of influence of both low and high temperatures on mechanical properties of the metallic materials of which the aircraft is constructed, depending on whether the machine is to be flown at sub or supersonic speeds. (A general, Q general)

225-A. U. S. Steel Opens New Research Center. *Steel Processing,* v. 42, June 1956, p. 341-343, 350.

Fundamental and applied research laboratories mark important step in improving steelmaking methods and developing new steel and new uses for steels. (A9, ST)

226-A. Steel and Power. *Steel Review,* nos. 3-6, Apr. 1956, p. 1-6.

Supply and consumption of coking coal for the steel industry. (A4, B22, ST)

227-A. The Fire Properties of Metallic Uranium. *U. S. Atomic Energy Commission, TID-*8011, Apr. 1956, 11 p.

Under suitable conditions, uranium is capable of self-sustaining combustion in air, N_2, O_2 and CO_2. Intense, localized heat is emitted. Factors contributing to uranium pyrophoricity. (A7, U)

228-A. Kaiser Expansion to Ladle 450,000 More Tons Into Steel-Hungry West. *Western Metals,* v. 6, June 1956, p. 53-54.

Two 65-ton oxygen converter vessels are among the additions contributing to increased tonnage of nearly 450,000 (A4, D8, ST)

229-A. A Dictionary of Metallurgy. A. D. Merriman and J. S. Bowden. *Metal Treatment and Drop Forging,* v. 23, June 1956, p. 225-232.

Definitions of terms from "solidus" to "spraying (metal)." (To be continued.) (A10)

230-A. How Do You Store Your Patterns? E. J. McAfee. *Modern Castings,* v. 30, July 1956, p. 52-56.

Factors governing space requirements, rules for eliminating old and obsolete patterns, weatherproof storage, shelving and pattern identification considerations. (A5, E17)

231-A. (French.) **French Contribution to Metallurgy.** Paul G. Bastien. *Revue de Métallurgie,* v. 53, no. 5, May 1956, p. 321-331.

Review of the essential discoveries and developments relating to iron and steelmaking, metallurgy of nonferrous metals and alloys, control instruments and the evolution of scientific research in metallography and physics of metals. (A general)

232-A. (Pamphlet.) **The British Iron and Steel Association, Annual Report 1955.** 124 p. Registered Office, 11 Park Lane, London W1, England.

Reports on the work of the various divisions of the association. Photographs. (A9, ST, Fe)

233-A. (Book.) **Annual Statistical Report for 1955.** *American Iron and Steel Institute,* 136 p. 1956. American Iron and Steel Institute, 150 East 42nd St., New York 17, N. Y.

Statistics concerning employment, coke and coal, blast furnaces, ingots and steel for castings, steel products, exports and imports, ores and production by countries. (A4, ST)

234-A. (Book.) **Proceedings of the Eighth International Congress on Theoretical and Applied Mechanics.** 529 p. 1953. Faculty of Science of the University of Istanbul, Turkey.

Presents condensations or extracts of 336 technical papers in English, French, German and Italian. (A general)

235-A. (Book.) **Metallurgical Thermochemistry. v. I. Metal Physics and Physical Metallurgy.** O. Kubaschewski and E. Ll. Evans. Rev. 2nd Ed. 410 p. 1956. Pergamon Press Ltd., 4-5 Fitzroy Sq., London, W1, England.

Monograph on the science of applied thermodynamics covers theory and technique; shows examples. (A general)

236-A. (Book.) **The European Steel Pipe and Tube Industry.** 103 p., 1955. Industry Division, Economic Commission for Europe. Available from the Sales Section, European Office of the United Nations, Palais des Nations, Geneva, Switzerland. $.60.

Study of the prospects of tube consumption and prices in Europe. (A4, ST)

237-A. (Book.) **Atomic Theory for Students of Metallurgy.** William Hume-Rothery. 3rd Ed. 342 p. 1955. Institute of Metals, 4 Grosvenor Gardens, London, S.W. 1, England. $4.50.

General background, structure of the free atom, assemblies of atoms, free-electron theory of metals, Brillouinzone theory, electrons, atoms, metals and alloys. (A general)

238-A. (Book.) **Engineering Metallurgy.** L. F. Mondolfo and Otto Zmeskal. 1955, 397 p. McGraw-Hill, 330 W. 42 Street, New York, 36, N. Y. $8.00.

A college text for engineers whose primary interests are not in the metallurgical field. Emphasis is on theoretical reasons behind the operations. (A general)

239-A. (Book.) **Mineral Facts and Problems.** *Bureau of Mines Bulletin* 556. 1042 p. 1956. U. S. Department of the Interior. Available from the U. S. Government Printing Office, Washington, D. C. $5.75.

Comprehensive survey of production, consumption and the general economic and technologic positions of metals, alloys, ores, coal, petroleum, minerals and their allied industries. (A4)

B

Raw Materials and Ore Preparation

149-B. Investigation of Washer Slimes as a Source of Uranium. R. C. Meaders, H. W. Adam, J. W. Cookston, O. F. Tangel and A. C. Richardson. *Battelle Memorial Institute (U. S. Atomic Energy Commission),* BMI-235, June 1950, 29 p.

Treatment with sulphuric acid dissolves the uranium which can be recovered by treating the pulp with an anion-exchange resin. Uranium from this source would be very costly. Graph, tables. (B14, U)

150-B. Recovery of Uranium From North Dakota Lignites. R. A. Ewing, H. W. Adam, F. W. Miles, A. E. Bearse and A. C. Richardson. *Battelle Memorial Institute (U. S. Atomic Energy Commission),* BMI-237, July 1950, 51 p.

Mineralogy of sample studied and mineralogical composition estimated. Results of float-sink tests and chemical analyses. Hydrometallurgical recovery methods investigated briefly. Graph, tables. (B14, U)

151-B. Recovery of Uranium From Phosphate Rock. E. F. Stephan, John Chocholak, Iver Igelsrud and H. A. Pray. *Battelle Memorial Institute (U. S. Atomic Energy Commission),* BMI-238, June 1950, 100 p.

Processes investigated from recovery of uranium from phosphate rock and from superphosphate and phosphoric acid derived from phosphate rock. Leaching and precipitation techniques. Graphs, diagrams, tables. 13 ref. (B14, U)

152-B. A-Ore on the Plateau. *Chemical and Engineering News,* v. 34, June 18, 1956, p. 2968-2973.

Ion exchange and solvent extraction are significant among new developments in the processing of uranium ore. Diagram, photographs. (B14, U)

153-B. Direct Measurement of Ferrous Ion Mobility in Liquid Iron-Silicate by a Radioactive Tracer Technique. M. T. Simned, Ling Yang and G. Derge. *Journal of Metals,* v. 8, May 1956, p. 690-692.

Experiments furnished direct evidence of the electrolytic migration of ions in silica-saturated iron silicate and a measurement of the ionic mobility at 1250° C. Diagram, graphs. 6 ref. (B21, S19, Fe)

154-B. Uranium in Canada. A. H. Lang and H. R. Steacy. *Mining Engineering,* v. 8, June 1956, p. 618-621.

Discovery and development of Canada's principal ore deposits. Photographs. (B10, A4, U)

155-B. Metallurgical Treatment of Uranium Ore. William L. Lennemann. *Mining Engineering,* v. 8, June 1956, p. 622-628.

Uranium recovery processes now being used in western mills. Diagrams, table, photographs. (B14, U)

156-B. Ultransonic Desliming and Upgrading of Ores. S. C. Sun and D. R. Mitchell. *Mining Engineering,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 205, June 1956, p. 639-644.

Proposed method depends primarily upon the stratifying and peptizing action caused when high-frequency sound waves are propagated upward through ore pulp in a cylinder tube. Ultrasonic stratification of mineral particles in water is experimentally verified. Diagram, photograph, graphs, tables. 16 ref. (B14)

157-B. Mineral Dressing. F. B. Michell. *Mining Journal (Annual Review),* 1956, May 1956, p. 123 + 8 pages.

Recent developments in comminution, sizing, gravity concentration, dense media separation and flotation; atomized ferrosilicon, magnetic and electrostatic separation processes; concentration of specific minerals. Photographs, diagrams. 42 ref. (B13, B14)

158-B. Cost of Uranium Recovery by the Amine Extraction Process. B. B. Klima, H. M. McLeod, Jr., A. D. Ryon and R. R. Wiethaup. *Oak Ridge National Laboratory (U. S. Atomic Energy Commission),* ORNL-1949, Sept. 1955, 36 p.

Estimated costs include the processing steps associated with clarification, solvent extraction, uranium precipitation, calcination and packaging of product. Diagrams, tables. (B14, U)

159-B. Theoretical Studies on Magnetic Separation. II. Effects of Demagnetizing Field on the Magnetization of Irregular Formed Mineral Particles. Saburo Yashima and Tadashi Ohyama. *Technology Reports Tohoku University,* v. 20, 1956, p. 197-211.

Average demagnetizing factor of liberated magnetite particles having irregular forms. Fundamental equation of magnetic force affecting a mineral particle under given field conditions. Diagrams, graphs. 4 ref. (B14, Fe)

160-B. (German.) **Development of the Iron Ore Pelletizing Process.** Kurt Meyer. *Stahl und Eisen,* v. 76, no. 10, Mar. 19, 1956, p. 588-595.

Selection of raw materials, balling and hardening of green pellets, rate of production, effect of the pellets on the operation of blast furnace. Pelletizing with simultaneous performance of special reactions. Tables, photographs, diagrams. 25 ref. (B16, D1, Fe)

161-B. Uranium Recovery Plants. A. Thunaes. *Canadian Mining Journal,* v. 77, June 1956, p. 123-151, 159-161.

Treatment and concentration of Canadian uranium ores at seven sites. (B14, U)

162-B. Size Reduction. R. V. Riley. *Chemical & Process Engineering,* v. 37, June 1956, p. 187-191.

Advances in comminution, including crushing, milling, fine grinding, fluid energy mills and size reduction machinery for special applications. (B13)

163-B. Some Changes in the Properties of Refractories at High Temperatures. C. Bodsworth. *Iron & Steel,* v. 29, June 1956, p. 297-301, 322.

Effect of the continuation of some structural changes, which may not be completed during firing, and of contamination in service. (B19, EG-d)

164-B. Removal of Uranium From Rand Leach Liquors With Anion Exchange Resins. V. Further Studies on

Process X Solutions. Norman N. Schiff. *Massachusetts Institute of Technology (U. S. Atomic Energy Commission),* AECD-4108, Mar. 1951, 6 p.

Effects of pH, temperature and retention time of leach liquor on resin capacity and precipitate grade. (B14, U)

165-B. Tests With the Aerofall Mill on a Rand Mine. L. A. Waspe. *Mining Magazine,* v. 94, June 1956, p. 325-334.

Plant layout, operation, production data and costs for milling gold-uranium ores. (B13, A5, U, Au)

166-B. Something New in Sintering. *Steel,* v. 139, July 2, 1956, p. 74, 76.

"Flying Saucer" blending machine and updraft sintering machine are features of new plant. (B16, Fe)

167-B. (Russian.) **New Refractory Materials for Smelting and Casting of High-Melting Metals.** G. V. Samsonov. *Ogneupory,* v. 21, no. 3, 1956, p. 122-135.

Survey of refractory materials for prospective use in smelting of high-melting metals. Bibliography of mostly foreign sources on the subject. (B19, C21, D general)

168-B. Design and Operation of No. 3 Sinter Strand at Jones and Laughlin's Benson Mines. R. G. Fleck and F. M. Hamilton. *American Institute of Mining and Metallurgical Engineers, Blast Furnace, Coke Oven and Raw Materials Conference, Preprint,* 1956, Apr. 1956, 5 p.

Details of installation started in 1952. (B16, A5)

169-B. The Lurgi Sintering Plant of the Steel Company of Canada. T. W. W. Trumper. *American Institute of Mining and Metallurgical Engineers, Blast Furnace, Coke Oven and Raw Materials Conference, Preprint,* 1956, Apr. 1956, 13 p.

Sinter is produced from screened ore, flue dust, mill scale and coke breeze for both blast furnace and openhearth in a plant designed and engineered by the company. (B16, A5, ST)

170-B. Ore Preparation Plant of the Steel Company of Wales Limited: Design, Operation, and Effect on Blast Furnace Performance. K. C. Sharp and H. R. Tufnail. *American Institute of Mining and Metallurgical Engineers, Blast Furnace, Coke Oven and Raw Materials Conference, Preprint,* 1956, Apr. 1956, 17 p.

Production of sinter and its effect on plant practice. (B16, B13, A5, ST)

171-B. Methods for Increasing Production Rate of Flue-Dust Sinter. E. C. Rudolphy and E. J. Whittenberger. *American Institute of Mining and Metallurgical Engineers, Blast Furnace, Coke Oven and Raw Materials Conference, Preprint,* 1956, Apr. 1956, 7 p.

Flue-dust sinter yield is increased by moisture control and additives such as ore fines, roll scale, return fines and granulated blast furnace slag. (B16)

172-B. Reaction Zones in the Iron-Ore Sintering Process. R. D. Burlingame, Gust Bitsianes and T. L. Joseph. *American Institute of Mining and Metallurgical Engineers, Blast Furnace, Coke Oven and Raw Materials Conference, Preprint,* 1956, Apr. 1956, 17 p.

Chemical composition of various zones. (B16, Fe)

173-B. Sintering Iron Ores and Concentrates at Extaca. Robert L. Bennett, Robert E. Hagen and Morris V. Mielke. *American Institute of Mining and Metallurgical Engineers, Blast Furnace, Coke Oven and Raw Materials Conference, Preprint,* 1956, Apr. 1956, 19 p.

Deals with operation of the sintering plant, both on fine iron ore and on magnetite concentrates from taconite. (B16, Fe)

174-B. Weirton's New 8-Foot Wide Iron-Ore Sintering Plant. Julius H. Strassburger. *American Institute of Mining and Metallurgical Engineers, Blast Furnace, Coke Oven and Raw Materials Conference, Preprint,* 1956, Apr. 1956, 9 p.

A new sintering machine and its auxiliary handling and processing equipment. (B16, A5, Fe)

175-B. A Kinetic Study of the Leaching of Molybdenite. William H. Dresner, Milton E. Wadsworth and W. Martin Fassell, Jr. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, June 1956, p. 794-800.

Effects of temperature, oxygen over-pressure and potassium hydroxide concentration evaluated. (B14, Mo)

176-B. Mechanism of Sulfate Formation During the Roasting of Cuprous Sulfide. C. L. McCabe and J. A. Morgan. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, June 1956, p. 800A.

Compositions of the various layers were established by Debye-Scherrer patterns, suggesting a sequence of reactions during roasting. (B15, Cu)

177-B. (Czech.) **Ferrochromium With Low Carbon Content.** Karel Protva. *Hutnik,* v. 6, no. 2, Feb. 1956, p. 41-44.

Methods of preparing a low-carbon ferrochrome. Importance of ferro-alloys as steelmaking additions; standards for them. (B22, B21, Fe-n)

178-B. (French.) **Sulfur Partition Between Gas, Slag, and Metal Phases.** E. T. Turkdogan. *Revue de Métallurgie,* v. 53, no. 5, May 1956, p. 332-342.

Indicates that in iron and steelmaking processes the sulfur transfer to and from the slag and metal phases reaches equilibrium. The sluggishness of the carbon-oxygen reaction, compared with the others taking place at the slag-metal interface, is discussed. (B21, D general)

179-B. (German.) **Contribution to the Development of the Creep Test of Fire-Clay Bricks.** Kamillo Konopicky and Wilhelm Lohre. *Stahl und Eisen,* v. 76, no. 12, June 14, 1956, p. 749-756.

Evaluation of literature on the assessment of the softening behavior of refractory bricks. Main concepts of the creep of ceramic product. Conditions for the performance of creep tests under compression load. Fused silica standards for checking uniform testing temperature. (B19)

180-B. (German.) **Experiences in Changing-Over to Natural Gas Burning in Heating and Melting Furnaces.** Hugo Siegers. *Stahl und Eisen,* v. 76, no. 13, June 28, 1956, p. 805-809.

Characteristics of natural gas and construction of pipe lines. (B18, J2, D2, ST)

181-B. (Hungarian.) **Extraction of Iron From Bauxite by .Hydrometallurgy** Zoltan Horvath and Nandor Wieder. *Kohaszati Lapok.* v. 9, no. 4, Apr. 1956, p. 179-182.

Suggestion of method and economic and technical advantages. (B14, Al, Fe)

182-B. (Hungarian.) **New Agents for Promoting High-Speed Settling of Red Mud in the Alumina Industry.** Tihamér Gedeon Jozsef Környei and Imre Veres. *Kohaszati Lapok,* v. 9, no. 4, Apr. 1956, p. 182-184.

Application of ground wild chestnuts, scrap aluminum or its alloy; economic and technical advantages. (B14, Al)

183-B. (Japanese.) **The Magnetic Roasting of the Ni-Cr Iron Ore in South Asia District by Fluidized Bed.** Tetsutaro Mitsuhashi, Manabu Ueno and Minoru Tanaka. *Iron & Steel Institute of Japan, Journal,* v. 42, no. 6, June 1956, p. 461-466.

Report on the operation and advantages in roasting of laterite. The fluidized-bed reactor makes feasible the roasting of fine ores in the stabilized condition and is primarily used in the oxidation roasting of sulfide ores. (B15, Fe)

C

Nonferrous Extraction and Refining

212-C. The Distribution of Plutonium in the Systems Uranium-Silver and Uranium-Silver-Gold. D. E. McKenzie. *Canadian Journal of Chemistry,* v. 34, June 1956, p. 749-756.

Theoretical background for selection of silver as an extractant for plutonium from neutron-irradiated uranium. Graphs, tables, diagram. 7 ref. (C general, Au, Ag, U, Pu)

213-C. Solving the Practical Problems of Titanium Production. M. G. Mastin. *Engineering and Mining Journal,* v. 157, June 1956, p. 78-87.

Production processes, costs, purification of sponge, future possibilities. Photographs, graph, diagrams. (C4, B14, Ti)

214-C. Electrorefining for Removing Fission Products From Uranium Fuels. Leonard W. Niedrach and Arthur C. Glamm. *Industrial and Engineering Chemistry,* v. 48, June 1956, p. 977-981.

General feasibility of an electrorefining process for uranium has been demonstrated both with regard to operability and ability to give decontamination. Tables, diagram, graphs. 19 ref. (C23, U)

215-C. Experiments on the Semi-Continuous Casting of Bronze. E. C. Ellwood, J. C. Prytherch and E. F. Phelps. *Institute of Metals, Journal,* v. 84, May 1956, p. 319-326 + 2 plates.

Design and construction of a machine (using unlubricated graphite dies) for casting rods and tubes of small dimensions. Casting process and properties of the product. Diagrams, graph, tables, photographs. 8 ref. (C5, Cu)

216-C. Production of Uranium Metal. D. S. Arnold, C. E. Polson and E. S. Noe. *Journal of Metals,* v. 8, May 1956, p. 637-639.

An intricate series of process steps are required to produce uranium reactor fuel elements to meet the exacting product demands. Photograph, diagrams. (C general, U)

217-C. Separation of Germanium and Cadmium From Zinc Concentrates by Fuming. H. Kenworthy, A. G. Starliper and A. Ollar. *Journal of Metals,* v. 8, May 1956, p. 682-685.

Germanium and cadmium may be removed effectively by heating certain sphalerite concentrates in an inert atmosphere. Tables, graphs. 6 ref. (C28, Zn, Cd, Ge)

218-C. Purification of $GeCl_4$ by Extraction With HCl and Chlorine. H. C. Theuerer. *Journal of Metals,* v. 8, May 1956, p. 688-690.

Method is simple and readily adaptable to the quantity production of germanium dioxide, either from primary crude oxide or from germanium scrap material. Diagram, graphs, table. 10 ref. (C4, Ge)

219-C. Purification of Gram Amounts of Americium. J. S. Coleman. *Los Alamos Scientific Laboratory (U. S. Atomic Energy Commission),* LA-1975, Nov. 1955, 39 p.

Ion exchange, solvent extraction and precipitation methods; details of two ion-exchanger processes for the separation of americium from rare earths. Diagrams, photograph, tables, graphs. 20 ref. (C general, Am)

220-C. The First Commercial Plant for Electrowinning of Chromium. M. C. Carosella and J. D. Mettler. *Metal Progress,* v. 69, June 1956, p. 51-56.

High-purity chromium is produced from high-carbon ferrochromium which is dissolved and 99.80% chromium electrodeposited in diaphragm cells from a chromium-alum solution. Photographs, tables, diagram. (C23, Cr)

221-C. Production of Uranium Metal. D. S. Arnold, C. E. Polson and E. S. Noe. *Mining Engineering,* v. 8, June 1956, p. 608-610.

Description of process steps to produce uranium reactor fuel elements to meet stringent specifications. Photograph, diagrams. (C general, U)

222-C. Extraction Metallurgy. Graham Oldham. *Mining Journal (Annual Review),* May 1956, p. 141 + 4 pages.

Review of world-wide literature on recent developments covers metal reduction processes, chemical extraction, exchange resins, roasting and smelting, electrolytic methods, metal refining. Photographs. 34 ref. (C general)

223-C. (German.) **Methods and Processes of Metal Degasification. I.** W. Espe. *Vakuum-Technik,* v. 5, no. 3, May 1956, p. 39-54.

Causes of gas inclusions, amount and type of gas, degasification of metals during smelting. Graph, diagrams, photographs, tables. (C25)

224-C. (German.) **Review of Processes for Production of Metallic Uranium and Thorium for Use as a Nuclear Fuel.** Günter Wirths. *Zeitschrift für Metallkunde,* v. 47, no. 5, May 1956, p. 280-288.

High-purity nitrate solutions are obtained by extraction. Methods for obtaining compounds suitable for producing metals by reduction. Customary reduction processes. Experiments in pyrometallurgical refining of uranium. Tables. 17 ref. (C general, B14, Th, U)

225-C. Research on Intermetallic Containers for Melting Titanium. *Alfred University. Quarterly Progress Report No. 1, for Wright Air Development Center, Contract No.* AF33 (616)3172, Sept. 1, 1955, Nov. 30, 1955. 10 p.

Reports on preparing intermetallic compounds, fabricating crucibles, melting procedure and evaluating melts. (C5, B19, Ti)

226-C. Process for Fission-Product Removal From Uranium-Bismuth Reactor Fuels by Use of Fused-Salt Extraction. O. E. Dwyer. *A.I.Ch.E. Journal,* v. 2, June 1956, p. 162-168.

Process design considerations and proposed flow sheets. (C general, Bi, U)

227-C. Liquid-Metal Extraction for Processing of Spent Fuel. A. F. Voigt, A. H. Daane, E. H. Dewell, R. G. Clark, J. E. Gonser, J. F. Haefling and K. L. Malaby. *A.I.Ch. E. Journal,* v. 2, June 1956, p. 169-173.

Use of silver, cerium and lanthanum for removal of plutonium and fission products from irradiated uranium by liquid-metal extraction. (C28, U, Ag, La, Ce)

228-C. Continuous Casting of Bronze. J. B. Mohler. *Automation,* v. 3, July 1956, p. 42-45.

Furnace operation, material handling, control variables and die details in relation to production flexibility. (C5, Cu)

229-C. Vacuum Distillation of Metals. A. J. Martin. *Metal Industry,* v. 88, June 8, 1956, p. 473-476.

Theoretical considerations. (To be continued.) (C22)

230-C. Vacuum Distillation of Metals. II. Practical. A. J. Martin. *Metal Industry,* v. 88, June 15, 1956, p. 495-498.

Reduction processes, purification processes, decorative, protective and miscellaneous applications. (C25, C22, L25)

231-C. The Electrolytic Preparation of Small Quantities of Alkali Metals. P. S. Baker, G. F. Wells and W. R. Rathkamp. *Oak Ridge National Laboratory (U. S. Atomic Energy Commission),* ORNL-1468, Jan. 1953, 15 p.

Development and operation of miniature cell for preparation of alkali metals from small amounts of their salts. (C23, Li, EG-e)

232-C. Distillation Separation of Zirconium and Hafnium. Gordon C. Williams, S. V. Galginaitis, E. G. Baker, Jr., A. H. Isaacs, E. W. Holzknecht, R. A. Gillespie, R. G. Moody and L. A. Graham. *University of Louisville, (U. S. Atomic Energy Commission),* NY00-1009, Aug. 1950, 165 p.

Distillation techniques applied to the separation of hafnium and zirconium phosphorus oxychloride complexes. Discusses determination of vapor pressure of technical $ZrCl_4$, and chemical methods of converting $POCl_3$ and PCl_5 complexes of $ZrCl_4$ to ZrO_2. (C22, Hf, Zr)

233-C. (Russian.) **Preparation of Pure Metals by Zone Crystallization. I. Preparation of Pure Tin. II. Preparation of Pure Tin by a Combination of Zone Crystallization and Purification From Highly Volatile Impurities by Lengthy Heating in High Vacuum.** B. N. Aleksandrov, B. I. Verkin and B. G. La'zarev. *Fizika Metallov i Metallovedenie,* v. 2, no. 1, 1956, p. 93-104.

Relation of impurity content of tin to number and rate of zone recrystallizations. Redistribution of impurities in lead ingots after repeated fractional zone recrystallizations. Relation of residual resistance to number of zone crystallizations for various kinds of lead and to thickness of layer being heated. (C general, Pb, Sn)

234-C. (Russian.) **Investigation of the Mechanism of the Purification of Metals by Zone Recrystallization.** B. N. Aleksandrov, B. I. Verkin, I. M. Lifshits and G. I. Stepanova. *Fizika Metallov i Metallovedenie,* v. 2, no. 1, 1956, p.105-119.

Role of movements of the crystallization boundary as well as role of diffusion and convection mixing within the zone. Equations for complete intermixing within the zone. Distribution of impurities, use of radioactive tracers as impurity metals. (C general, Pb, Sn)

235-C. Mechanism of Electrical Conduction in Molten Cu_2S-Cu Cl and Mattes. Ling Yang, G. M. Pound and G. Derge. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, June 1956, p. 783-788.

Specific conductance and its temperature dependence measured over entire composition range. Facts are interpreted in terms of electron energy level diagrams by analogy to the situation in solids. (C23, Cu)

D

Ferrous Reduction and Refining

242-D. Blast Furnace Oxygen Operatons. Julius H. Strassburger. *Blast Furnace and Steel Plant,* v. 44, June 1956, p. 626-635.

Plant equipment and operation, moisture control of oxygenated air, economics of blast enrichment. Tables, diagrams, photographs, charts. (D1)

243-D. Desulphurization of Basic Iron With Calcium Carbide. E. J. Whittenberger, A. J. Deacon and L. C. Hymes. *Blast Furnace and Steel Plant,* v. 44, June 1956, p. 644-647, 689.

Efficiency of desulphurization in 65-ton ladles of basic hot metal evaluated as a function of initial sulphur content, iron temperature and/or reladling practice, rate of injection and depth of immersion of the graphite injection tube. Tables, diagrams, photograph. (To be continued.) (D9, Fe)

244-D. Electric Smelting Furnaces. Marvin J. Udy. *Electrochemical Society, Journal,* v. 103, June 1956, p. 353-355.

The kilowatt per cubic foot of molten material and constancy of the peripheral ohms factor are important to operation. Tables. 2 ref. (D5)

245-D. Future Developments in Steelmaking. H. H. Burton. *Engineer,* v. 201, May 25, 1956, p. 555-556.

Ingot making, hot working and heat treatment discussed from standpoint of meeting future engineering needs. (D general, F general, J general, ST)

246-D. Oxygen Steel in the United States. C. R. Austin. *Iron and Steel Engineer,* v. 33, May 1956, p. 64-68.

Layout and operation of oxygen converter steel plant. Steel quality is good, production flow is even and process is flexible. Photograph, diagram, graphs. (D8, ST)

247-D. Steels Degassed During Pouring of Large Forging Ingots. Arthur Tix. *Metal Progress,* v. 69, June 1956, p. 81-87.

When well-made steel is teemed into a mold in a vacuum chamber half of the hydrogen is sucked out and the steel is free of flakes even if sections as large as 30-in. rounds are air cooled from the forging heat. Graphs, tables, diagrams, photographs. (D8, D9, ST)

248-D. (German.) **Converter Lining in the Surface Blow Steel Converter Plant at Donawitz.** Alfred Wegscheder. *Stahl und Eisen,* v. 76, no. 10, Mar. 19, 1956, p. 595-599.

Oxygen steel converters are lined with cheapest commercial magnesite bricks in the bottom and with special magnesite bricks in the cylindrical shell. Diagrams. (D8, ST)

249-D. Desulphurization of Liquid Pig Iron by Blowing With Lime Powder. B. Trentini, L. Wahl and M.

Allard. *Iron and Steel Institute Journal,* v. 183, June 1956, p. 124-133.

New process using high concentrations of lime in the gas produces extremely effective conditions of contact between desulfurizing agent and liquid pig iron, owing to use of immersed tuyeres. (D9, CI)

250-D. Study on a Model of Aerodynamics of a Maerz-Type Open-Hearth Furnace With Preheated Gas and a Comparison With Siemens and Terni Furnaces. G. Husson, G. Cohen de Lara and R. Durand. *Iron and Steel Institute, Journal,* v. 183, June 1956, p. 134-145.

Tests established that Maerz-type furnace flame, given uniform excess of air, is much shorter than that of Siemens and Terni furnaces. (D2, D8)

251-D. The History and Practice of the Acid Bessemer Steelmaking Process in West Cumberland. F. B. Cawley and D. R. Wattleworth. *Iron and Steel Institute, Journal,* v. 183, June 1956, p.198-207.

Effect of manganese and silicon contents; slag-metal relationships in the acid converter; design of converter; use of oxygen. (D3, A2, ST)

252-D. Control in the Acid Bessemer Process. Application of Volume Debitgraphe, Opacimeter, and Flame Pyrometer. P. J. Leroy, J. G. Galey and F. B. Cawley. *Iron and Steel Institute, Journal,* v. 183, June 1956, p. 208-224.

Effect of bath depth, blowing rate and silicon content on air consumption per ton of iron. Continuous recording of flame opacity is an effective method of determining endpoint of blow. (D3, ST)

253-D. Ingot Heat Conservation. L. H. W. Savage and M. D. Ashton. *Iron and Steel Institute, Journal,* v. 29, June 1956, p. 229-235.

Cooling of 15-ton rimming-steel ingots between teeming and stripping. (D9, CI)

254-D. Control in the Acid Bessemer Process. P. J. Leroy, J. G. Galey and F. B. Cawley. *Iron and Steel Institute, Journal,* v. 29, June 1956, p. 222-228; disc., p. 275-277.

Application of "Volume Debitgraphe" air flowmeter, flame opacimeter and flame pyrometer. (D3)

255-D. Acid Bessemer Steelmaking. F. B. Cawley and D. R. Wattleworth. *Iron and Steel Institute, Journal,* v. 29, June 1956, p. 217-221; disc., p. 275-277.

History and practice in West Cumberland. Design and operation of converters. (D3, A2, ST)

256-D. Vacuum Casting of Large Forging Ingots Beginning in U. S. *Steel Processing,* v. 42, June 1956, p. 327.

Process is expected to improve quality of steel in large ingots by reducing amount of trapped gases and thus eliminating small hidden defects. (D8, D9, ST)

257-D. (German.) **Continuous Casting of Rimmed Basic Bessemer Steel.** Hans Kosmider, Herbert Neuhaus and Arthur Weyel. *Stahl und Eisen,* v. 76 no. 11, May 31, 1956, p. 668-678.

Determination of temperature losses from converter to continuous casting unit, interpretation of solidification phenomena, segregation behavior, behavior of cast billets in rolling. (D9, E25, F23, ST)

258-D. (Russian.) **Influence of Certain Factors on the Extent of the Oxidation Zone.** B. N. Zherebin, V. M. Minkin, I. D. Nikulinskii, V. M. Obsharov, I. A. Suchkov and M. Ia. Ostroukhov. *Stal',* v. 16. no. 5, May 1956, p.391-396.

Increased blast as well as increased temperature and moisture content of the blast tends to lead to an increase of the oxidation zone in the blast furnace. Extent of the zone depends on kinetic energy of the blast. (D1)

259-D. (Russian.) **Regulation of the Flow of Gases in the Blast Furnace.** N. N. Chernov and I. F. Domnitskii. *Stal',* v. 16, no. 5, May 1956, p. 402-408.

For better regulation of gas flow, measuring instruments must be supplemented by analyses of waste gas taken at regular intervals along two perpendicular diameters. Optimum working conditions are achieved when carbon dioxide content at center of cross section is 2 to 3% lower than at the periphery. (D1, S18)

260-D. (Russian.) **Temperature Check of Molten Steel With the Aid of Thermocouples.** S. G. Otlivanov and I. A. Sokolov. *Stal',* v. 16, no. 5, May 1956, p. 409-415.

Procedures and results of industrial use of thermocouples for control of temperature in steel smelting furnaces. (D general, S16, ST)

261-D. (Russian.) **An Improved Method for Preliminary Deoxidation of Steel.** N. I. Shirokov, B. G. Petukhov and A. I. Borodulin. *Stal',* v. 16, no. 5, May 1956, p. 415-422.

Preliminary deoxidation of metal in the openhearth furnace, with ferromanganese but without ferrosilicon, improves efficiency of furnace and quality of metal, and reduces costs. (D2, ST)

262-D. (Russian.) **Influence of Technology of Smelting and Casting of Rimmed Steel on the Amount of Lamination Rejects.** P. S. Plekhanov, N. S. Mikhilets, A. E. Gorelkina and N. G. Nikulin. *Stal',* v. 16, no. 5, May 1956, p. 422-430.

Influence of technological factors on development of defects in upper parts of ingot with subsequent lamination discussed on basis of several experimental and a large number of industrial smeltings. Optimum conditions of smelting and casting. (D9, E10, ST)

263-D. (Russian.) **Smelting of Rail Steel From Low-Manganese Cast Iron Without Adding Ferromanganese During Rimming.** E. Ia. Zarvin, N. S. Mikhailets and K. V. Demykin. *Stal',* v. 16, no. 5, May 1956, p. 431-437.

Study of reduction of low-manganese cast iron shows that during the rimming a manganese content below the previously required 0.2% has no adverse effect on the quality of the steel smelted and leads to technological advantages. Tables, graphs, diagrams. (D general, ST, CI)

264-D. (Russian.) **Injection of Air Into the Nozzle Chambers of Openhearth Furnaces.** L. S. Klimasenko, M. Ia. Medzhibozhskii, E. I. Korochkin, N. I. Bovin and D. Z. Savostin. *Stal'.* v. 16, no. 5, May 1956, p. 462-465.

Injection of compressed air into the nozzle chambers reduces smelting time by 30-40 min. due to a more complete combustion of fuel in the working area of the furnace, formation of a better torch and a certain increase of the thermal load. (D2)

265-D. Burdening a Blast Furnace for Minimum Costs. David R. Bailey. *American Institute of Mining and Metallurgical Engineers, Blast Furnace, Coke Oven and Raw Materials Conference Preprint,* 1956, Apr. 1956, 15 p.

Application of linear programming techniques to metallurgical and economic factors in burdening has afforded a very promising method of attacking this problem. (D1)

266-D. A Comparison of Blast Furnace Penetration With Model Studies. J. B. Wagstaff and W. H. Holman. *American Institute of Mining and Metallurgical Engineers, Blast Furnace, Coke Oven and Raw Materials Conference, Preprint,* 1956, Apr. 1956, 11 p.

A new correlation of air penetration which agrees with other data. Data taken by rodding the tuyeres are examined critically. (D1, Fe)

267-D. Desulphurization of Blast Furnace Iron With Injected Calcium Carbide. Daniel E. Watkins and J. R. McFarland. *American Institute of Mining and Metallurgical Engineers, Blast Furnace, Coke Oven and Raw Materials Conference,* 1956, Apr. 1956, 7 p.

A consistent and reproducible method for removing sulphur from iron in blast furnace ladles. Equipment is simple to operate, install and maintain. (D9, D1, Fe)

268-D. Desulphurization of Molten Iron. J. N. Hornak and E. J. Whittenberger. *American Institute of Mining and Metallurgical Engineers, Blast Furnace, Coke Oven and Raw Materials Conference, Preprint,* 1956, Apr. 1956, 13 p.

Injection technique was effectively used with calcium carbonate, burnt lime, calcium cyanamide and calcium carbide. (D2, Fe)

269-D. Low Fuel Rates Obtained With Three-Foot Blast Furnace Using Prepared Ores and Coke-Anthracite Mixtures. Russell C. Buehl and Miles B. Royer. *American Institute of Mining and Metallurgical Engineers, Blast Furnace, Coke Oven and Raw Materials Conference, Preprint,* 1956, Apr. 1956, 15 p.

Taconite pellets and a coarse ore-sinter mixture were smelted at fuel rates of 1450 and 1700 lb. per net ton compared with 2000 lb. per ton required for Mesabi ore. (D1, B18)

270-D. The New High-Grade Iron Ores and Agglomerates and Their Effect on Coke Rates. John Griffen. *American Institute of Mining and Metallurgical Engineers, Blast Furnace, Coke Oven and Raw Materials Conference, Preprint,* 1956, Apr. 1956, 8 p.

The new iron ores and beneficiated raw materials will reduce slag volumes, which will create difficulties in obtaining control of sulphur in the hot metal and will make the use of low-sulphur coking coals a matter of vital importance. (D1, B14, Fe)

271-D. Operating Experiences With High Beneficiated Burdens. D. Joyce, W. P. Dowhaniuk and B. Marsden. *American Institute of Mining and Metallurgical Engineers, Blast Furnace, Coke Oven and Raw Materials Conference, Preprint,* 1956, Apr. 1956, 6 p.

Improvements in sinter cooling and handling, and more attention to the chemical and physical properties of the sinter produced will lead to additional benefits. (D1, B16, Fe)

272-D. Problems Connected With Basic-Lined Hot-Metal Mixers. H. Parnham. *British Ceramic Society, Transactions,* v. 55, May 1956, p. 339-358; disc., p. 358-368.

Factors influencing lining life, mixer design and slagging. (D general, B19)

273-D. Temperature and Heat Flow in the Hearths of Blast Furnaces With and Without Underhearth Cooling. V. Paschkis and Taghi Mirsepassi. *Iron and Steel Engineer,* v. 33, June 1956, p. 116-128; disc., 128-132.

The all-carbon hearth should have less salamander penetration than

combinations of ceramic and carbon with equal cooling. Underhearth cooling is feasible from a thermal standpoint and will reduce size of salamanders, but will not affect frequency of sidewall breakouts. (D1)

274-D. One Hundred Years of Bessemer Steelmaking. A. B. Wilder. *Journal of Metals,* v. 8, June 1956, p. 742-753.

Historical development of steelmaking processes. (D3, ST)

275-D. On the Basic Pneumatic Processes of Steelmaking. P. Coheur and H. Kosmider. *Journal of Metals,* v. 8, June 1956, p. 754-759.

New methods of blowing permit a better gearing of steel plant to market and raw material conditions. (D3, D8, ST)

276-D. The L-D Process in Austria. B. Matuschka. *Journal of Metals,* v. 8, June 1956, p. 760-761.

Data on the production of steel with the use of an oxygen lance in a converter-like vessel. Results are identical to openhearth grades. (D8, ST)

277-D. Future Trends of the Pneumatic Process. J. E. Stukel. *Journal of Metals,* v. 8, June 1956, p. 763.

Two recent European developments may prove quite effective in producing quality steel at a low cost. (D8, D3, ST)

278-D. New Control Instruments for Bessemer Steelmaking. P. Leroy. *Journal of Metals,* v. 8, June 1956, p. 764-768.

Volume-debitgraphe flowmeter, two-color pyrometer, flame pyrometer, opacimeter. (D3, ST)

279-D. (Czech.) **Diffusion Deoxidation in the Basic Openhearth Furnace.** Zdenko Zdenek. *Hutnik,* v. 6, no. 2, Feb. 1956, p. 37-41.

Evaluation of various methods of diffusion deoxidation and the effect on consumption of alloying and deoxidizing additions as well as on the quality of steel. (D2, ST)

280-D. (French.) **Some Factors Affecting Electrode Consumption in the Electric Arc Furnace.** D. H. Houseman. *Revue de Métallurgie,* v. 53, no. 5, May 1956, p. 343-350.

Direct potential drop method of electrode measurement used to sort electrodes into groups, on a resistivity basis, to show the direct and statistically valid relationship between resistivity and consumption. Long term trials, using only electrodes of low and medium resistivity, have shown that large savings are possible in electrode costs. (D5)

281-D. (French.) **Studies on a 10-Cwt. Arc Furnace (About 500 Kg.)** W. H. Glaisher, M. Preston and J. Ravenscroft. *Revue de Métallurgie,* v. 53, no. 5, May 1956, p. 351-378.

To determine the most economical operating conditions, the investigation was primarily concerned with the electricity and electrode consumption, roof wear and the melting phase of the process. (D5)

282-D. (French.) **Desulphurization of Iron by Powdered Lime.** B. Trentini, L. Wahl and M. Allard. *Revue de Métallurgie,* v. 53, no. 5, May 1956, p. 388-399.

Technique based on the injection of lime in a stream of inert gas, with a very low sulphur content resulting, within a treatment time of only 3 to 4 min. (D9)

283-D. (German.) **A Contribution to the Heat Diagram of the Blast Furnace.** Paul Reichardt. *Stahl und Eisen,* v. 76, no. 12, June 14, 1956, p. 731-738.

Calculation and graphic representation of the heat capacity and the heat requirements of the charge, of the heat available in the gas stream, and of the temperature gradient in the single temperature ranges. (D1, ST)

284-D. (German.) **The Conditions of Precipitating Oxide Contaminations of the Steel in the Pouring Ladle.** Erwin Plöckinger. *Stahl und Eisen,* v. 76, no. 12, June 14, 1956, p. 739-748.

Importance of the single operating phases of steelmaking for the degree of purity obtained in the steel. Aspect and composition of inclusions observed in steel. (D9, ST)

285-D. (German.) **The Killing of Deep-Drawing Steel in the Mold (Chemically Capped Steel Ingots).** Wilhelm Gerling and Karl-Otto Zimmer. *Stahl und Eisen,* v. 76, no. 13, June 28, 1956, p. 799-805.

Defects encountered in killed, semikilled and effervescent soft steels. Chemically "capped" steel, its technological properties and economic importance. (D9, ST)

286-D. (Japanese.) **Blowholes in Iron and Steel. V. Some Examples of Blowhole Formation by Hydrogen.** Takehiko Fujii. *Iron & Steel Institute of Japan, Journal,* v. 42, no. 6, June 1956, p. 467-475.

An analysis of the cause of blowholes in steel, when cast in steel and sand molds, and in large killed ingots. (D9, E11, N1, Fe, ST)

E

Foundry

369-E. High-Silicon Aluminum Casting Alloy. John C. Wagner. *Metal Progress,* v. 69, June 1956, p. 91-92.

Addition of dilute phosphor copper reduces segregation and increases machinability. Micrographs, photographs. (E25, G17, Al)

370-E. What Iron Foundries Are Doing With the Injection Process. George P. Dahm. *Modern Castings,* v. 29, June 1956, p. 50-53.

Use of the injection process for desulphurization, increasing carbon content, improving mechanical properties. Micrographs, diagram, photographs. (E25, Q general, CI)

371-E. How Design and Operation Influence Cupola Emission. Ray C. Ortgies. *Modern Castings,* v. 29, June 1956, p. 54-56.

Design factors influencing emission of dust are bed height, charging doors, stack height, igniters, material handling and blower air volume. Diagrams, tables, photographs. (E10, A8)

372-E. Moisture Measuring on a Small Budget. George DiSylvestro. *Modern Castings,* v. 29, June 1956, p. 57.

For about $35 it is possible to build a moisture tester that will provide an accuracy within 0.1% in 5 min. Photographs. (E18)

373-E. You Can Make Clean, Sound Aluminum Alloy Castings. Jack Morgan. *Modern Castings,* v. 29, June 1956, p. 60-62.

Control of grain size, oxidation, alloy structure and alloy purity. Photographs. (E25, Al)

374-E. Sulphur Addition Makes Unusual New Iron. F. B. Rote, E. F. Chojnowski and J. T. Bryce. *Modern Castings,* v. 29, June 1956, p. 79-83.

Sulphur stabilizes carbides and permits production of thick metal sections free of primary graphite. Excellent casting surfaces are produced in either green sand or shell molds. Micrograph, graph. (E25, CI)

375-E. Economics of Investment Cast Vacuum Alloys. F. Kenneth Iverson. *Precision Metal Molding,* v. 14, June 1956, p. 130-135.

Analysis of costs and equipment. Diagram, table, photographs, graph. (E15, SG-h)

376-E. Some Experiments on the Production of Nodular Cast Iron. S. N. Anant Narayan and S. Visvanathan. *TISCO,* v. 3, Apr. 1956, p. 48-52 + 1 plate.

Production of nodular iron by metallurgical measures during melting did not prove practicable. Calcium and barium salts did not induce formation of spheroidal graphite. Table. 17 ref. (E25, CI)

377-E. How to Deoxidize With Phosphor Copper. Robert A. Colton. *Foundry,* v. 84, July 1956, p. 80-82.

Informative data on what phosphor copper is, why it should be used and how to get the most benefit from its use. (E25, Cu)

378-E. Die Casting Magnesium. Sherwood H. Egbert. *Foundry,* v. 84, July 1956, p. 83-87.

West Coast firm incorporated some new techniques into its practice for successfully die casting magnesium. (E13, Mg)

379-E. Brass Casting Defects—Their Causes and Cures. Harry St. John. *Foundry,* v. 84, July 1956, p. 91-93.

Considers shift, crush, swell, variation in wall thickness, misrun, coldshut, hot cracks, sand wash, scab and sand blow. (E11, Cu)

380-E. Aspects of Corrosion-Resisting Steel Castings. W. G. Boustred. *Foundry Trade Journal,* v. 100, June 7, 1956, p. 409-412.

Types of corrosion-resisting steels; chemical composition; treatments for stabilization of stainless steel structures; manufacturing methods; melting and casting of alloys. (E general, SS, ST)

381-E. Use of Refractories in Low-Frequency Induction Furnaces for Melting Copper Alloys. II. Maurice Cook, C. L. M. Cowley and E. R. Broadfield. *Industrial Heating,* v. 23, June 1956, p. 1265 + 7 pages.

Types of refractories and methods of lining construction. (To be continued.) (E10, B19, Cu)

382-E. Notes on the Shape of Feeder Heads. N. K. Ipatov. *Iron and Steel Institute, Journal,* v. 29, June 1956, p. 293-294. (From *Liteinoe Proizvodstvo,* no. 3, Mar. 1955, p. 3-4.)

The important feature in the shape of a feeder head is not so much minimum surface or maximum degree of thickness as the rate of fall of the liquid metal level during the solidification process. (E23, E25)

383-E. The Use of Sodium Silicate in Steel Casting Molds and Cores. Robert D. Fenity. *Journal of Steel Castings Research,* no. 5, May 1956, p. 7-9, 14, 15.

Literature survey indicates successful use on a commercial scale in fabrication of metal casting molds and cores. Advantages are more rapid production and fewer sand defects. (E18, E19, E21, ST)

384-E. Durability of Foundry Sands and Properties of Deteriorated Foundry Sands. D. K. Faurschou. *Journal of Steel Castings Research,* no. 5, May 1956, p. 1-6, 15.

Testing procedures and equipment, properties at room and elevated temperatures, coatings on used sands. (E18, CI)

385-E. Automation in Gravity Die-Casting. *Light Metals,* v. 19, June 1956, p. 182-183.

Electronically controlled gravity casting machine permits production of nonferrous castings in permanent molds with unprecedented speed and precision. (E13, A5, Al)

386-E. The Pecoshell Automatic Shellmoulder. *Metalworking Production,* v. 100, June 8, 1956, p. 715-716.

Fully automatic single-station shell molding machine is particularly suited to large quantity production. (E16)

387-E. (Czech.) **Research on Czechoslovak Foundry Sands From 1950 to 1955.** Josef Dlezek. *Slévarenstvi,* v. 4, no. 5, May 1956, p. 145-154.

Principle task, development and organization of research on production and utilization of sands. (E18)

388-E. (Czech.) **Pouring of Steel Steam Chests for Turbines.** Frantisek Maran. *Slévarenstvi,* v. 4, no. 5, May 1956, p. 154-158.

Chromium-vanadium-tungsten steel is satisfactory from the point of view of mechanical properties. Atmospheric risers are used to increase metal yield. (E11, E23, Q general, CI)

389-E. (Czech.) **Imperfect Bonding in Compound Cast Bronzes.** Stanislav Lorenc. *Slévarenstvi,* v. 4, no. 5, May 1956, p. 158-162.

Cause of defect is seen in phosphorus content. The tin-containing bronzes for compound casting must therefore not exceed the given limit of phosphorus. (E general, Cu)

390-E. (Dutch.) **The Application of Chill and Wedge Tests During the Melting of Gray Cast Iron.** A. Bordes. *Metaalinstituut T. N. O.,* no. 38, Jan. 1956. 8 p.

Rapid tests suitable for controlling melting conditions and material properties. (E10, CI)

391-E. (Dutch.) **The Lining of Acid Cupola Furnaces.** A. Bordes. *Metalen,* v. 11, no. 8, Apr. 30, 1956, p. 175-181.

Raw material, patching, drying, wear, cost per ton and refractory-consumption data gathered while 24 acid-lined cupolas were operating under different conditions. (E10, B19)

392-E. CO_2 Hardening of Cores. Edward Magder. *Canadian Metals,* v. 19, June 1956, p. 40, 42-44.

Early experience in Canadian gray iron foundry shows worthwhile saving with further cost reduction expected, foundry operation better integrated and scrap losses cut. (E21, CI-n)

393-E. Application of Insulated Feeders to Sand Castings in Long-Freezing-Range Copper Alloys. R. S. Jackson. *Foundry,* v. 100, June 1956, p.487-493.

Insulating or exothermic sleeves are unlikely to be advantageous with most small or light-section castings, but may be economical with large casting where the use of feeders is essential to prevent shrinkage defects. (E23, E11, Cu)

394-E. Hot-Blast Cupolas in the Foundry. W. Heinrichs and W. Brüker. *Foundry Trade Journal,* v. 100, June 14, 1956, p. 463-464.

Construction, blast supply, control, economics and holding. (E10)

395-E. Glascast Process Precision Casting for Light Alloys. *Light Metal Age,* v. 14, June 1956, p. 18-20.

Low-cost one-piece molds, capable of withstanding extremely high heats and sudden temperature changes, yield blemish-free castings with surface finishes of 20 to 40 microin. (E15, Al)

396-E. How They Poured the Biggest Aluminum Casting. Ken Calkins. *Light Metal Age,* v. 14, June 1956, p. 20-21.

The casting of airplane wing jig components containing as much as 37 cu. ft. of aluminum. (E11, Al)

397-E. Shell-Moulding Practice. D. F. Bailey. *Metal Industry,* v. 88, June 22, 1956, p. 520-522.

Open and closed-system coreblowing methods; mold blowing. (To be continued.) (E16)

398-E. Sand Mould Penetration Testing. II. A Practical Comparison of the Effectiveness of Sand Compaction by Several Foundry Moulding Techniques. D. H. Houseman. *Metallurgia,* v. 53, no. 320, June 1956, p. 249-252.

The mercury penetration tester was used to compare the effectiveness of sand compaction around a simple pattern by hand, pneumatic, jolt-squeeze and sand slinger ramming. (E18, E19)

399-E. Continuous Casting of Cast Iron Bars. G. J. Shaw. *Metal Treatment and Drop Forging,* v. 23, June 1956, p. 233-236.

Variables influencing the final bar when using the open system. (E23, CI)

400-E. Most Neglected Phases of Cupola Operation. W. R. Jaeschke. *Modern Castings,* v. 30, July 1956, p. 24-27.

Review of fundamentals including coke size, scrap iron and charging practice. (E10, CI)

401-E. Once There Was a Hard Spot in an Aluminum Die Casting. Donald L. Colwell and Oldrich Tichy. *Modern Castings,* v. 30, July 1956, p. 28-31.

Suggestions for improving machinability. (E13, Al)

402-E. Better Pouring Means Better Castings. Earl Solomon. *Modern Castings,* v. 30, July 1956, p. 49-50.

A wide variety of crucibles and ladles are available to fit the specific operation for which they will be used. (E23)

403-E. Soluble Cores. W. A. Dubovick. *Precision Metal Molding,* v. 14, July 1956, p. 38-40.

Where smooth, devious internal passageways are a functional requirement, soluble cores offer greater design latitude. (E15)

404-E. How to Control Temperature in Die Casting Dies. I. Mechanics of Heat Transfer. W. M. Halliday. *Precision Metal Molding,* v. 14, July 1956, p. 47 + 4 pages.

Factors affecting die temperature; heat transfer to and from a die. (E13)

405-E. (Czech.) **Chills for the Semi-continuous Casting of Aluminum and Alloys of Light Metals.** Otakar Rittich. *Hutnik,* v. 6, no. 2, Feb. 1956, p. 50-52.

Design of chills and factors affecting the service life of the chill mold. (E19, E25, Al)

406-E. (Russian.) **Intricate Chill Casting of Ferrous and Nonferrous Alloys.** B. Iu. Feigel'son. *Liteinoe Proizvodstvo,* 1956, no. 5, May 1956, p. 8-10.

Technical and economic advantages of chill casting complex parts by mechanical methods. (E16, Fe-n, EG-a)

407-E. (Russian.) **An Installation for Reclamation of Burned Mold Sand.** E. A. Glozman and G. A. Petrov. *Liteinoe Proizvodstvo,* 1956, no. 5, May 1956, p. 11-14.

A corona discharge separator for reclamation of the reusable portion of burned mold sand. (E18)

408-E. (Russian.) **Conditioning Influence of the Pouring Temperature on the Solidification of Steel Castings.** B. B. Guliaev, I. I. Lupyrev and P. E. Kovalenko. *Liteinoe Proizvodstvo,* 1956, no. 5, May 1956, p. 20-22.

An experimental study of kinetics of solidification and the temperature field of a steel casting allowed to cool in a sand mold. (E25, ST)

409-E. (Book.) **Steel Foundry Practice.** John Howe Hall. 496 p. 1955. Penton Publishing Company, Penton Building, Cleveland 13, Ohio. $12.00.

Thirteen chapters on as many different practices followed in the production of steel castings. (E general, CI)

F

Primary Mechanical Working

152-F. Principles of a Metallurgically and Physically Balanced Hot Strip Mill. M. Alexander Leishman. *Blast Furnace and Steel Plant,* v. 44, June 1956, p. 619-625.

Equipment, relationships enabling calculation of optimum coil lengths and weights, nomogram for rapid estimation of optimum coil lengths and weights for any combination of rolling conditions. Graphs, tables. (F23)

153-F. Promotion of Fluid Lubrication in Wire Drawing. D. G. Christopherson and H. Naylor. *Institution of Mechanical Engineers, Proceedings,* v. 169, no. 35, 1955, p. 643-653; disc., p. 666-678.

Die wear can be reduced by supplying oil to the entry at a pressure comparable with the yield stress of the wire. Pressure can be generated by causing the wire to approach the die through a tube of slightly larger diameter than the wire sealed on to the inlet side of the die. Photographs, diagrams micrographs, tables, graphs. 8 ref. (F28, F1)

154-F. Investigation of the Mechanics of Wire Drawing. J. G. Wistreich. *Institution of Mechanical Engineers, Proceedings,* v. 169, no. 35, 1955, p. 654-665; disc., p.666-678.

Round wire was drawn slowly and without backpull through dies with bores in the shape of truncated cones in a study of relations between external forces and process parameters. Photograph, diagrams, tables, graphs, micrographs. 18 ref. (F28)

155-F. History of the Fontana Blooming Mill. Reynold MacDonald. *Iron and Steel Engineer,* v. 33, May 1956, p. 94-97.

Modification and additions necessitated by conversion to peacetime steelmaking operation. Photographs. (F23, ST)

156-F. Computation of Roll Force and Torque in Cold-Rolling by Modern Theory. P. W. Whitton. *Journal of Applied Mechanics,* v. 23, June 1956, p. 307-311.

A combination of current theory on strip elastic compression, yield-stress curves in cold-rolling and friction coefficient between rolls and strip. Table, graphs, diagram. 11 ref. (F23)

157-F. (German.) **Predetermination of Deformation Forces in the Extrusion of Light Metal Sections.** H. Hornauer. *Aluminium,* v. 36, no. 6, June 1956, p. 350-356.

Processes involved in extrusion are analyzed and expressed in equations. Considerable attention is paid to resistance to change of shape and rate of deformation. Diagrams, photographs, nomograph. 14 ref. (F24, Al)

158-F. (German.) **Electrically Heated Pit Furnaces.** Hans Langenbach. *Stahl und Eisen,* v. 76, no. 10, Mar. 19, 1956, p. 614-618.

Arrangement of the heating channel and ingot rows. Floor space required, power consumption, operation, control of atmosphere, scaling loss. Photographs, diagrams, graph. 1 ref. (F21)

159-F. Effect of Modernization on Efficiency. Denis McQueen Potter. *Iron & Steel,* v. 29, June 1956, p. 303-308.

A case history, with discussion of melting shop, soakers, mills, traffic and rolling stock, wharf facilities, balance in operations, output per employee and fuel efficiency. (F23, ST)

160-F. The Importance and Growing Reality of Aluminium-Alloy Forgings in Industry. A. W. Willis. *Light Metals,* v. 19, June 1956, p. 174-176.

Selection of forging alloys, design of forged components, cost of tooling, surface finish and civilian applications. (F22, T general, Al)

161-F. Slitting Aluminum Coiled Stock. Carl S. Vogel. *Modern Metals,* v. 12, June 1956, p. 40, 42, 44, 46.

In fabricating practices coil can effect economies over flat sheet. The pros and cons of slitting lines and technical factors involved. (F29, A4, Al)

162-F. The Rolling of Metals and Alloys. XI. E. C. Larke. *Sheet Metal Industries,* v. 33, no. 350, June 1956, p. 411-417.

Corrected methods for calculating energy requirements involved in hot rolling slab and strip materials. (To be continued.) (F23)

163-F. Holes Forged In. *Steel,* v. 139, July 2, 1956, p. 67-70.

In cored forgings the holes are forged at right angles to each other in a one-shot process. Forgeability, uses and performance considered. (F22)

164-F. Basic Forging Concepts. I. Equipment and Part Design. Lester F. Spencer. *Steel Processing,* v. 42, June 1956, p. 319-326, 350-351.

Basic forging tools, forging draft angles, die closure, flash extension, warpage. (F22)

165-F. Integrated Plant Stretches West's Extrusion Output. *Western Metals,* v. 6, June 1956, p. 55-57.

Production of aluminum casement windows. (F24, T10, Al)

166-F. (German.) **Analysis of Flattening Phenomena During Groove Rolling.** *Neue Hütte,* v. 1, no. 6, May 1956, p. 353-362.

Derivation of new formulae; adaptation of formulae for groove rolling of bars; determination of the quantity of metal extended and flattened during the rolling process. Tables, photograph, diagrams. 10 ref. (F23, F29)

167-F. (Polish.) **Rolling and Drawing of Alloy ZnAl 1.** Kazimierz Janas. *Wiadomosci hutnicze,* v. 12, no. 4, Apr. 1956, pp. 111-115.

Rolling temperature, thermal conductivity and other parameters affecting plastic working of copper, aluminum and this alloy. Wire drawing conditions. Comparison of mechanical properties of wire strength with copper or aluminum wire. (F23, F28, Q23, P11, Cu, Zn, Al)

168-F. (Swedish.) **Conditioning of Steel Ingots and Billets.** Gösta Kihlgren. *Jernkontorets Annaler,* v. 140, no. 4, 1956, p. 314-344.

Different machines for grinding, turning, planing and milling. Economic and technical aspects. (F21, A4, ST)

169-F. Basic Formulas for Roll Design and Rolling of Alloy Steels. A. M. Cameron. *Iron and Steel Engineer,* v. 33, June 1956, p. 55-74; disc., p. 74.

Empirical data on roll designs for standard sections such as rounds, squares, flats, hexagons and octagons. (F23, AY)

170-F. Induction Heating in Tubemaking. S. O. Evans. *Iron and Steel Engineer,* v. 33, June 1956, p. 75-79; disc., p. 79.

Application of induction heat must usually be based on some special advantages of the process to compensate for the higher cost per unit of energy. Some possible advantages are scale-free heating, flexibility, ease of shutdown, ability to handle small heats of steel, and ability to heat with marked difference in temperature zones. (F26, J2, ST)

171-F. Modernization of Blooming and Slabbing Mills at Sparrows Point Plant. P. E. Appel, M. Whitmore, H. W. Dorset and H. C. Henschen. *Iron and Steel Engineer,* v. 33, June 1956, p. 80-93; disc., p. 86, 93.

Engineering, mechanical and electrical features; soaking pit improvements. Conversion from 46 to 54 in. mill. (F23)

172-F. On the Calculation of Wire Drawing Force. I. The Case of Conventional Wire Drawing With Work Hardening. II. The Case of Wire Drawing With Back Tension. Kenichi Nakamura, Hiroo Takahashi and Juzo Kurihara. *Journal of Mechanical Laboratory (Japan),* v. 1, 1955, p. 26-28.

A formula of drawing force in wiredrawing through a conical die is derived and then converted to a formula for drawing force with back tension. (F28)

173-F. Now, Tool Steel Extrusions. *Steel,* v. 139, July 9, 1956, p. 92.

Molten glass is used as lubricant in Ugine-Sejournet extrusion process which produces shapes too intricate to roll. (F24, T6, TS)

174-F. (Czech.) **How to Roll Thin Sheet Steel.** Maxmilian Honzik. *Hutnik,* v. 6, no. 1, Jan. 1956, p. 12-14.

Comparison of advantages and disadvantages of two methods of cold rolling. Camparative economy and manufacturing planning. (F23, ST)

175-F. (Czech.) **Forging of Large Forgings.** Vilém Burda. *Hutnik,* v. 6, no. 2, Feb. 1956, p. 44-49.

Present state of techniques of forging large machine parts and measures for avoiding cracking. Proper techniques and hydraulic dies cut down amount of machining required afterwards. (F22, CN-m)

176-F. (French.) **Some Rolling Factors That Influence the Production of Heavy Sheets.** M. Hoffmann. *Centre de Documentation Sidérurgique, Circulaire d'Informations Techniques,* v. 16, no. 5, 1956, p. 957-964.

Studies the influence of rolling temperature, billet size and the shape of ends of the sheets on production capacity. (F23)

G

Secondary Mechanical Working

235-G. Bandsawing Titanium. L. O. Montgomery and G. William Bauer. *American Machinist,* v. 100, June 4, 1956, p. 124-125.

New setup method and revised tooth grind for standard blades improve cutting efficiency and indicate further possible improvements. Photographs, diagrams. (G17, Ti)

236-G. Five Faults in Wet Abrasive Cut-Off and How to Correct Them. P. C. Dooley. *American Machinist,* v. 100, June 4, 1956, p. 130-133.

Mechanics of wheel-face breakdown; methods of coolant application; causes and cures for wheel drift, heavy burr, burning the work, step cut and chamfer at top. Diagrams. (G17)

237-G. The Formability of Aluminium Alloys. D. A. Barlow. *Engineering,* v. 181, May 1956, p. 393-396.

Calculation of deep-drawing properties, forming limits, blank holder load and friction, ironing. Diagrams, graph, tables. 9 ref. (G4, Q23, Al)

238-G. Machining Metals by Electro-Erosion. W. Ullman. *Industrial Diamond Review,* v. 16, May 1956, p. 85-88, 90.

The arc, trigger, oscillator circuit, and Agietron methods of electro-erosion. Diagrams, graphs. (G17)

239-G. Electrolytic Grinding. G. Koscholke. *Industrial Diamond Review,* v. 16, May 1956, p. 90-92.

Surface material may be removed from a sintered carbide workpiece by the influence of an electric current. Diagrams, graph, photographs. micrographs. (G18, C-n)

240-G. How and Where to Use Flame Gouging. *Industry & Welding,* v. 29, June 1956, p. 52-54, 57.

Procedures, applications and equipment. Diagrams, photographs. (G22)

241-G. Tips on Grinding and Buffing Stainless Welds. Joseph J. Saber. *Industry & Welding,* v. 29, June 1956, p. 76-78.

Finishing techniques and factors determining final finish. Photographs. (G18, L10, SS)

242-G. Tryout Press Puts Squeeze on Downtime. W. G. Patton. *Iron Age,* v. 177, June 14, 1956, p. 95-97.

A 150-ton hydraulic press solves the problem of production die tryout without interfering with production. By holding shop downtime to a minimum, it has more than paid for itself in a year. Photographs. (G1)

243-G. How to Choose the Best Drawing Lubricant. E. L. H. Bastian. *Iron Age,* v. 177, June 14, 1956, p. 102-104.

Problem of finding the best lubricant for a particular metal and a

particular job is solved by grouping lubricants into three basic classes. Table, photograph. (G21)

244-G. Low-Cost Techniques Simplify Special Bends in Stamping. Federico Strasser. *Iron Age,* v. 177, June 7, 1956, p. 124-126.

Formulas, hints and alternate methods for the solution of almost any special bending problem. Diagrams. (G3, G6)

245-G. Standard Tooling Forms Titanium Wheels. W. L. Cameron and C. H. Savery. *Iron Age,* v. 177, June 14, 1956, p. 100-101.

A special government order for 12 truck wheels is filled by their fabrication on a standard set-up for steel. Diagram, photographs. (G general, T21, Ti)

246-G. Roll Grinding and Roll Grinding Wheel Application. William Pope. *Iron and Steel Engineer,* v. 33, May 1956, p. 125-128; disc., p. 128-129.

Machines, grinding fluids and compounds, wheel trueing and dressing and wheel selection for specific applications. Photograph. (G18)

247-G. The Big Step From Manual to Semi-Automatic Flame-Cutting. *Welding Engineer,* v. 41, June 1956, p. 35-36.

Machine increases production speeds by 75 to 200% and maintains great accuracy and economy. Photographs. (G22)

248-G. (German.) **Shielded Arc Cutting of Aluminum.** K. Domke. *Aluminium,* v. 36, no. 6, June 1956, p. 344-347.

Two new processes, one using a consumable steel rod electrode and the second a nonconsumable tungsten electrode. Numerical data concerning the current strengths and voltages for various cutting speeds, and gas consumption. Photographs, graph, diagrams, tables. 3 ref. (G22, Al)

249-G. (Russian.) **Study of the Temperature of the Vapor Phase Arising During the Electrospark Machining of Metals.** L. S. Palatnik and A. N. Liulichev. *Zhurnal Tekhnicheskoi Fiziki,* v. 26, no. 4, Apr. 1956, p. 832-838.

Method of measuring spark temperature. Temperature of spark between iron electrodes in relation to electrode diameter, current and electrode material. Graphs, tables, spectrograms. 21 ref. (G17)

250-G. (Russian.) **Use of Spectral Analysis for the Study of the Vapor Phase Arising During the Electrospark Machining of Metals.** L. S. Palatnik and A. N. Liulichev. *Zhurnal Tekhnicheskoi Fiziki,* v. 26, no. 4, Apr. 1956, p. 839-849.

Effect of material, polarity, shape and porosity of metal electrodes. Selective evaporation. Electrospark machining of various metals, using graphite electrodes. Effect of length of time and procedures. Spectrograms. 21 ref. (G17, S11)

251-G. Productivity by Oxygen Cutting. E. Seymour-Semper. *British Welding Journal,* v. 3, June 1956, p. 226-233.

Advantages over mechanical methods of plate edge preparation, general factors in productivity, multiple cutting, electronic control. (G22)

252-G. Built-Up Segmental Press Tools. *Mechanical World and Engineering Record,* v. 136, June 1956, p. 261-263.

Features accurate surface grinding. Each segment is preferably made exactly to size rather than to the small amount of available tolerance. (G18)

253-G. Deep Hole Drilling. II. E. Dinglinger and P. Grodzinski. *Mechanical World and Engineering Record,* v. 136, June 1956, p. 268-273.

Single-edged tool offers suitable conditions for application of sintered carbide to the drilling of deep holes. (G17, C-n)

254-G. How To Tool With Plastics. II. Guessing Is Gone From Toolmaking With Plastics. *Metalworking Production,* v. 100, June 1, 1956, p. 656-660.

Combining a laminated face with a cast core provides advantages of both techniques and produces a tool with a strong, tough surface while the large core area is quickly filled with the cast material. (G2)

255-G. Dieing Presses. Some Comments on Their Application and Tooling Techniques. I. Press Applications. II. Tool Design for Dieing Presses. S. C. Gillbanks and J. Galway. *Sheet Metal Industries,* v. 33, no. 350, June 1956, p. 359-367; disc., p. 367-369.

Examples of improved output resulting from efficiently designed dieing presses and tooling. (G1)

256-G. Press Brakes and Their Tools. IV. John Waller. *Sheet Metal Industries,* v. 33, no. 350, June 1956, p. 371-374, 419.

Use of a press brake to form awkward articles which are difficult to handle on an orthodox press. (To be continued.) (G1)

257-G. Mechanization in General-Line Tin-Box Making. John W. Langton. *Sheet Metal Industries,* v. 33, no. 350, June 1956, p. 375-378, 418.

Review of the progress of mechanization. Discusses round and rectangular seamless boxes and circular make-up containers. (G general, T10, Sn)

258-G. Forming With Epoxy-Faced Dies. John Delmonte. *Tool Engineer,* v. 37, July 1956, p. 84-86.

Successful forming and drawing of sheet metal by plastic-faced metal dies has demonstrated the remarkable durability and versatility of this application of epoxy resins. (G2, G4)

259-G. Automation and Conveyors Cut Stamping Costs at Ford. Arthur H. Allen. *Tool Engineer,* v. 37, July 1956, p. 98-101.

Press installations, press line automation, welding and assembly operations. (G3, A5, K general)

260-G. Tape Control for Jig Boring Holds Production Promise. J. J. Jaeger. *Tool Engineer,* v. 37, July 1956, p. 102-107.

Application of numerical control to the jig borer makes economic production of short runs of precision parts possible without elaborate setups and extensive tooling. (G17, S18)

261-G. (Czech.) **Electro-Erosive Machining of Metals.** Vl. Hermoch. *Elektrotechnika,* v. 21, no. 1, Jan. 1956, p.12-15.

Electro-erosion includes anode-mechanical machining and electrode-spark machining: principles and procedures. (G17)

262-G. (Czech.) **Machinability of Steel.** A. Vendr and M. Mikovec. *Strojirenstvi,* v. 6, no. 2, Feb. 1956, p. 103-110.

Machinability in relation to cutting speeds, resistances and quality of surface. Testing methods, effect of chemical composition and structure. Czech and foreign steels compared. (G17, CN, AY)

263-G. (Russian.) **Methods of Fire Trimming Metals.** M. S. Shlionskii. *Stal',* v. 16, no. 5, May 1956, p. 446-449.

Metal trimming procedures with gas and oxygen shears. (G22)

264-G. How Tool Design Affects Cutting Forces. Joseph C. Kozacka. *American Machinist,* v. 100, July 2, 1956, p. 85-87.

Dynamometer tests show that each component of the cutting force is increased by use of negative rakes. Direction of grinding marks and design of chipbreakers are also factors. (G17)

265-G. Centralized Coolant Filtration: Cuts Tool Cost; Increases Production 15%. Howard D. Klitgord. *American Machinist,* v. 100, July 2, 1956, p. 88-91.

Used on cutting fluid for turret lathes and automatic screw machines, this system removes particles under 25 mu. in., thus minimizing edge buildup and abrasion. (G17, G21)

266-G. Bacterial Inhibitors for Cutting Oil. H. O. Wheeler and E. O. Bennett. *Applied Microbiology,* v. 4, May 1956, p. 122-126.

Five compounds were found that completely inhibited all bacteria for 60 days under test conditions. A procedure is recommended for testing bacterial inhibitors in soluble oils. (G21)

267-G. Study on High Speed Machining of Metal. II. Hidehiko Takeyama and Eiji Usui. *Journal of Mechanical Laboratory (Japan),* v. 1, 1955, p. 20-21.

Two types of tool dynamometers for measurement of cutting force by magnetostriction phenomenon. (G17)

268-G. Hot Forming Titanium. Gilbert C. Close. *Light Metal Age,* v. 14, June 1956, p. 12-13, 29.

A case history dealing with use of resistance heating technique. (G1, G6, Ti)

269-G. Form Tools by Electrical Discharge Machining. N. P. Cici. *Machinery,* v. 62, July 1956, p. 148-153.

High-frequency discharges are directed from a negatively charged tool and through a dielectric fluid to the positively charged workpiece, removing metal by electro-erosion. (G17)

270-G. Contour Rolling of Temperature Resistant Aircraft Components. Frank J. Altmann. *Machinery,* v. 62, July 1956, p. 180-187.

Unique process for economically displacing metal to provide strong, light parts requiring practically no subsequent machining. All malleable structural metals can be contour rolled. (G11, G17)

271-G. Universal Die Cuts Cost of Impact Extruding at North American. Frank J. Pesak. *Machinery,* v. 62, July 1956, p. 194-200.

Various shaped parts can be produced by simply changing the punch die ring, stripper guide and knockout, thus reducing to a minimum the amount of tooling required for different extrusions. (G5)

272-G. Lubrication in Drawing. I. Failures and Causes. Eugene D. Viers. *Steel,* v. 139, July 9, 1956, p. 86-89.

Types of defects and their correction by lubrication. Photographs, micrograph. (To be continued.) (G21, G4)

273-G. Influence of Surface-Active Agents on the Dimensions of Chip Elements (in Cutting). G. I. Epifanov. *Henry Brutcher Translation No.* 3719, 6 p. (From *Doklady Akademii Nauk SSSR,* v. 104, no. 1, 1955, p. 68-71.) Henry Brutcher, Altadena, Calif.

Effect of various surface-active cutting fluids on size of individual slip elements of metal chips. Methyl

alcohol, oleic acid, ethyl laurate and carbon tetrachloride were used. (G21, Al, Fe, Cu)

274-G. (English.) **Speed Effect on Metal Machining.** Hidehiko Takeyama, Terumi Murai and Eiji Usui. *Journal of Mechanical Laboratory (Japan),* v. 1, 1955, p. 59-61.

As the cutting speed increases, the chip thickness becomes thinner, the shear angle becomes larger, and the shearing fracture in the shear zone takes place more uniformly. (G17)

275-G. (French.) **Research on the Impact Extrusion Process.** Robert Chopin. *Revue de l'Aluminium,* v. 33, no. 231, Apr. 1956, p. 365-369.

The techniques have been carried out with a hydraulic press equipped to record, by an electric process, the pressure on the punch and deformation of the blank. Additional research, conducted with strain gages and an extra fast camera, has been devoted to the influence of the extrusion ratio, the thickness of the blank, and nature of the metal. (G5, Q25, Al)

276-G. (Pamphlet.) **Forming of Titanium and Titanium Alloys.** W. P. Achbach. v. I-II. *Battelle Memorial Institute, Titanium Metallurgical Laboratory Report No.* 42, May 1956, 248 and 194 p.

A survey of the airframe industry was made to determine the state of art of forming titanium sheet. Thirteen major forming methods evolved from the assembled information. (G general)

H

Powder Metallurgy

103-H. Basic Research on Sintered Titanium Powder Analogous to "SAP" for High Temperature Strength. *Brush Laboratories Company, Bi-Monthly Reports, U. S. Navy Bureau of Aeronautics, Contract No.* NOas-55-505-C, Feb. 1955-Sept. 1955. 13, 13, 12, and 14 p.

Siliconizing of titanium hydride. Compaction, sintering, extrusion and evaluation of titanium compacts. Tables, graphs, diagrams. (H general, Ti)

104-H. The Porosity and Permeability of Hot-Compacted Copper Powder. G. Arthur. *Institute of Metals, Journal,* v. 84, May 1956, p. 327-332.

Effect of compacting pressure and temperature on permeability and porosity and on stability of the specimens on subsequent sintering. Diagram, graphs, tables. 16 ref. (H11, H14, Cu)

105-H. On the Rate of Sintering. Gerhard Bockstiegel. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May. 1956, p. 580-585.

Kuczynski's formula was derived for the case of nonspherical particles. Two similar formulae were derived, one describing the increase in tensile strength, the other describing the progress of shrinkage of a powder compact. Diagrams, graphs. 8 ref. (H15)

106-H. On the Use of Lineal Analysis for Obtaining Particle Size Distribution Functions in Opaque Samples. J. W. Cahn and R. L. Fullman. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 610-612.

A method for obtaining the distribution of sphere diameters and plate thicknesses (or pearlite spacings) from size distribution functions obtained along randomly oriented lines. 6 ref. (H11)

107-H. Boride Parts Resist Molten Zinc. R. M. Evans. *Materials & Methods,* v. 43, June 1956, p. 132-133.

Compacts composed of a boron compound plus a metal are heat and corrosion resistant and compare favorably in strength with graphite and gray iron. Graph, table, photographs. (H general, R6, B)

108-H. Titanium Powder Metallurgy. II. R. F. Bunshah, H. Margolin and I. B. Cadoff. *Precision Metal Molding,* v. 14, June 1956, p. 42-43, 137-138.

Fabrication techniques. Diagram. (H general, Ti)

109-H. Titanium Powder Metallurgy. III. R. F. Bunshah, H. Margolin and I. B. Cadoff. *Precision Metal Molding,* v. 14, July 1956, p. 41-42, 44, 73.

Design factors and some properties that can be obtained. (H general, Ti)

110-H. True Stresses in Compression Testing of Metal-Powder Compacts. V. G. Filimonov. *Henry Brutcher Translation No.* 3721, 4 p. (From *Zavodskaya Laboratoriya,* v. 21, no. 1, 1955, p. 82-84.) Henry Brutcher, Altadena, Calif.

A method of calculating and plotting true stress-strain curves. True and apparent stress-strain curves for specimens having pore volumes of 20 to 30%. (H11, Q25)

J

Heat Treatment

168-J. Isothermal Quenching in Salt Increases Tool Life. Diego Straniero. *American Machinist,* v. 100, June 18, 1956, p. 126-128.

A prolonged isothermal treatment in salt baths, much like martempering, improves the life of high-carbon, low-chromium drills by 5 to 7 times. Table, diagram, micrographs, graphs. (J26, TS)

169-J. Modern Case-Hardening Processes. P. F. Hancock. *Birmingham Metallurgical Society, Journal,* v. 36, Mar. 1956, p. 360-381.

Gas carburizing, control of case characteristics, furnaces, carbonitriding, induction and flame hardening, metallurgical considerations, practical applications and equipment. Table, photographs, diagrams, graphs, chart, (J28, ST)

170-J. Stress Relief Heat Treatment Equipment for Welds of All Kinds. K. Frauenfelder. *Brown Boveri Review,* v. 43, nos. 1-2, Jan.-Feb. 1956, p. 48-57.

A process based on the principle of induction heating which, using very simple equipment and requiring no costly brick furnaces, enables welds of all kinds to be treated on large or small workpieces. Photographs, table, diagram, graph. (J1)

171-J. Foundry Practice. XI. Heat Treatment. William H. Salmon and Eric N. Simons. *Edgar Allen News,* v. 35, May 1956, p. 101-102.

Annealing treatments to produce malleable irons and treatments involving rapid cooling. Micrographs, tables. (To be continued.) (J23, CI)

172-J. Normalizing and Quench-and-Temper Heat Treatment of Steel Products. James MacGregor. *Iron and Steel Engineer,* v. 33, May 1956, p. 108-115; disc., p. 115-119.

Furnace mechanical equipment for heat treating of tubular products. Normalizing furnace rotates the product. Diagrams, photographs. (J24, J26, J29, ST)

173-J. How to Heat Treat Titanium. Walter L. Finlay, W. W. Wentz and D. W. Kaufmann. *Materials & Methods,* v. 43, June 1956, p. 126-131.

How to take fullest advantage of titanium's inherent strength by means of quench-age heat treating cycles. Graphs, tables. (J26, J27, Ti)

174-J. Titanium Alloy Reclamation by Vacuum Annealing. D. N. Williams, R. I. Jaffee and C. A. Bentley, Jr. *Metal Progress,* v. 69, June 1956, p. 57-59.

Excessive hydrogen content can cause embrittlement and thermal instability of titanium alloys. Annealing in a vacuum furnace will reduce hydrogen contamination and restore ductility. Photograph, micrograph, table. (J23, Ti)

175-J. Effect of Molybdenum in Iron and Steel. Alvin J. Herzig. *Metal Progress,* v. 69, June 1956, p. 72-75.

Early studies on hardenability, effect on creep strength, research on temper brittleness, machinability, role of molybdenum in cast iron. Diagram. (J26 Q general, Mo, CI, AY)

176-J. Development and Application of the Iso-Hardness Diagram. A. E. Gurley and C. R. Hannewald. *Metal Treating,* v. 7, May-June, 1956, p. 2-6, 32-33.

Method for clearly evaluating carburized hardenability data. Graphs. (J26, J28, CN)

177-J. Controlled Atmosphere Heat Treating and Equipment. II. F. E. Harris. *Metal Treating,* v. 7, May-June 1956, p. 8-10, 30.

Construction and operation of furnaces. Diagram, photographs, graphs. (J2, CN)

178-J. Induction Heating Handling Problems. D. Warburton Brown. *Welding and Metal Fabrication,* v. 24, June 1956, p. 207-211.

Essential components of an induction heating system; evolution of a handling fixture; rotary motion. Diagrams. (To be continued.) (J2)

179-J. (Czech.) **Efficacious Method for Calculation of Jominy Curves and the Zone of Annealability.** Fr. Labonek. *Strojirenstvi,* v. 6, no. 3, Mar. 1956, p. 185-190; disc., p. 191-193.

Results indicate that mathematical methods do not provide a reliable basis for Jominy curves and for determining hardenability bands. Only experimental tests furnish correct data. Tables, graphs, diagram. 14 ref. (J26, ST)

180-J. Heat-Treatment Technique for Constructional Steels. V. A. Sharp. *Australasian Engineer,* v. 48, Apr. 1956, p. 63-66.

Selection of equipment, quenching and its mechanism. (J general, T26, ST)

181-J. Heat Treating Alloy Steels for Heavy Duty Axle Service. T. A. Frischman. *Automotive Industries,* v. 114, June 15, 1956, p. 50-51.

Case hardening and annealing of several alloys; composition and properties. (J26, J28, AY)

182-J. Heat Treatment of Copper and Aluminum Wire. H. J. Miller.

Industrial Heating, v. 23, June 1956, p. 1161 + 4 pages.

Five different heating methods used to satisfy annealing requirements for copper wire. (To be continued.) (J22, F28, Cu, Al)

183-J. The Rapid Unloader as Used in Conjunction With Induction Heating. Ellis J. Gottlieb. *Industrial Heating,* v. 23, June 1956, p. 1170, 1172, 1174, 1176.

Mechanism uses a series of cam-driven fingers to load and unload the induction heating coil. (J2, A5)

184-J. Batch Type Strip Annealing Furnaces—Multiple and Single Stack. II. C. F. Olmstead. *Industrial Heating,* v. 23, June 1956, p. 1201 + 10 pages.

Use of radiant tube single-stack furnace means a minimum of product inventory, rapid heating, economical loading and little floor area required per ton of product heated. (J23, ST)

185-J. Get Top Quality Carburizing With Zone Control. H. C. Harris. *Iron Age,* v. 177, June 21, 1956, p. 107-109.

Gas carburizing with zone controlled atmospheres is applied to the continuous production of steel gears. (J28, AY)

186-J. Commercial Bright Hardening of Stainless Steels. Fred Hunter. *Steel Processing,* v. 42, June 1956, p. 347-349.

Treatment of stainless and tool-steels in high-temperature muffle furnace results in fewer rejects, considerable savings and product improvement. (J26, J2, SS)

187-J. Versatile Allcase Furnace. James B. Smith. *Western Metals,* v. 6, June 1956, p. 58-59.

With gas-fired atmospheric batch-type furnace, distortion is minimized, batch heat treating can be used with any grade of steel, and automatic controls create a high production operation, easily handled by one man. (J general, ST)

188-J. Continuous Electric Furnaces. *Wild-Barfield Heat Treatment Journal,* v. 5, June 1956, p. 10-13.

Some furnaces suitable as electric furnaces. (J general)

189-J. (Czech.) **Economical Nature of Induction Heating in Modern Forge Shops.** E. Langer. *Strojirenstvi,* v. 6, no. 1, Jan. 1956, p. 32-35.

Advantages of induction heating, choice of right frequency, effective decrease in amount of surface scale formed. Soviet auto industry experiences. (J2, F22, ST)

190-J. (Russian.) **Thermal Electric-Spark Hardening of Machine Parts.** I. I. Kichkin. *Vestnik Mashinostroeniia,* v. 36, no. 5, May 1956, p. 65-68.

Suggests method of electric-spark hardening of metallic surfaces followed by an electric-arc heat treatment of the hardened surface which provides an additional protective layer beneath the initial one. (J2, ST)

191-J. Austempering Shovel Blades. H. Chapman. *Canadian Metals,* v. 19, June 1956, p. 46, 48, 50.

Thin-section carbon steel responds to this technique as satisfactorily as it does to hardening and tempering. (J26, CN)

192-J. Recent Heat Treatment Furnace Installations. *Metallurgia,* v. 53, no. 320, June 1956, p. 257-275.

A review with some typical examples. (J general)

193-J. Deep Freeze Your Casting for Stress Relief. *Precision Metal Molding,* v. 14, July 1956, p. 51-52.

Pent-up stresses that would distort the casting ordinarily are relieved by freezing. Machining is simplified. (J1, J26, Al)

194-J. (Czech.) **Stepwise Flame Hardening of Gears.** A. Strachota. *Strojirenska Vyroba,* v. 1, no. 4, Apr. 1956, p. 21-26.

New Czech instrument has heating tip that fits down along each individual gear tooth. The advantage is a very even depth of hardening for crest and trough of each tooth, while the core of the tooth still remains tough. Method results in better fatigue limits and less brittleness. Design and operation features. (J2, ST)

195-J. (Czech.) **Equipment and Techniques for Induction Heating.** J. Paukner. *Strojirenska Vyroba,* v. 4, no. 2, Feb. 1956, p. 70-76.

Survey of Czech and Soviet instruments, machines and techniques for induction heating, hardening, annealing, forging operations and welding and similar operations. (J2)

196-J. (Russian.) **Effective Procedures for Quench-Hardening Large Forgings of Structural Steel.** A. A. Astaf'ev and K. A. Ermakov. *Metallovedenie i Obrabotka Metallov,* 1956, no. 4, Apr. 1956, p. 35-45.

Mechanical properties of the steel in relation to temperature and time of isothermal transformation. Kinetics to transformation of supercooled austenite. Quenching temperatures and media.
(J26, N8, Q general, AY-n)

197-J. (Russian.) **Induction Heating of Intermediate Products of Heat-Resistant Alloy EI437 for Die Stamping.** I. I. Bezruchko, Ia. M. Ditiatkovskii and M. S. Aizikovich. *Metallovedenie i Obrabotka Metallov,* 1956, no. 4, Apr. 1956, p. 58-60.

Current frequency, heating temperature, depth of current penetration and other factors in heating of alloy from which turbine blades are to be stamped. (J2, SS-h)

198-J. (Russian.) **Determination of Hardenability of Chromium-Manganese Tool Steel.** V. V. Polovnikov. *Zavodskaia Laboratoriia,* v. 22, no. 5, May 1956, p. 565-567.

Quantitative relationship between stability of austenite in, and hardenability characteristics of, toolsteel. Problem of uniformity of methods involved in determination of each of these properties. (J26, N8, TS)

K — Joining

327-K. Welding of Thick Plates of Bureau of Mines Zirconium. D. C. Martin, R. D. Williams and C. B. Voldrich. *Battelle Memorial Institute (U. S. Atomic Energy Commission),* AECD-3863, July 1950, 42 p.

The inert-gas-shielded tungsten-arc process for welding zirconium, using helium as the shielding gas, was satisfactory. Welding had to be done in a controlled atmosphere chamber to prevent high weld hardnesses, and crystal-bar filler metal had to be used. Photographs, micrographs, graphs, diagrams, tables. (K1, Zr)

328-K. Furnace Brazing of Titanium. L. D. Girton. *Convair, Report No.* 7957 Add. 1, Mar. 1954, 4 p.

Strength, ductility and corrosion resistance of lap joints in 0.025 RC70 titanium, furnace brazed with fine silver. Table, diagrams. (K8, Ti)

329-K. Which Welding Process? G. F. W. Barrett. *Industry & Welding,* v. 29, June 1956, p. 58 + 6 pages.

Cost of joint preparation, direct labor costs and general overhead charges for various arc processes and oxy-acetylene welding. Tables. (K1, K2)

330-K. Resistance Welding High Temperature Alloys. P. M. Howard and D. Wilcox. *Industry & Welding,* v. 29, June 1956, p. 66 + 5 pages.

Conditions for welding, importance of proper cooling during stitch welding, welding dissimilar materials and production quality control. Photographs. (K3, SG-h)

331-K. Weld Aluminum Two Ways in Mass Production Setup. L. W. Kunkler. *Iron Age,* v. 177, June 7, 1956, p. 122-123.

Mass production of 13-ft. long aluminum fire bombs depends on a lineup of 20 manual and semi-automatic welding stations, using gas-shielded tungsten and metal arc methods. Photographs. (K1, Al)

332-K. Braze Strong Joints With Self-Fluxing Alloys. D. A. Canonico, Nicholas Bredzs and Harold Schwartzbart. *Iron Age,* v. 177, June 14, 1956, p. 98-99.

New lithium-bearing alloys join metals like stainless, nickel and cobalt-base alloys without use of reducing atmosphere. Joint strength is high, without voids or tendency to corrode. Photographs.
(K8, SS, Ni, Co)

333-K. Welding Clad Steel. William H. Funk. *Iron and Steel Engineer,* v. 33, May 1956, p. 104-107.

Quality workmanship in fabrication pays off in economical vessels and weldments which meet their design requirements. Principles and procedures for welding. Diagrams, photographs. (K1, K2, ST)

334-K. Inert Atmosphere Welding of Zirconium and Hafnium. J. S. Theilacker, E. D. Baugh, A. H. Kasberg and R. B. Stermon. *Journal of Metals,* v. 8, May 1956, p. 646-647.

Low thermal expansivity and very small volume change associated with phase transformations permit welding of complex structures with minimum of distortion. Equipment and procedures. Diagram, photograph. (K1, Zr, Hf)

335-K. Designing for Soldered Joints. J. B. Mohler. *Machine Design,* v. 28, June 14, 1956, p. 123-128.

Basic design and application considerations, alloy and fluxes, requirements of the soldering process, joint strength and solderability of metals. Diagrams, graphs, tables. (K7)

336-K. The Welding of Titanium. R. Fannon. *Welding and Metal Fabrication,* v. 24, June 1956, p. 192-193.

The inert-gas arc welding processes, argon-arc and Argonaut, are eminently suited to the fusion welding of titanium. Photographs, diagram, table. (K1, Ti)

337-K. Welding Shows Adaptability in Rocket Fabrication. Francis H. Stevenson. *Welding Engineer,* v. 41, June 1956, p. 32-34.

Techniques used on titanium and stainless steel; fixture design. Photographs. (K1, SS, Ti)

338-K. Uses Expand as 200-Series Stainless Passes Weldability Tests. *Welding Engineer,* v. 41, June 1956, p. 40-42, 44.

Physical properties, weldability tests, welding conditions, production outlook. Photographs, tables. (K9, Q23, SS)

339-K. (German.) **Shielded Arc Welding of Light Metals.** W. Mantel and L. Wolff. *Aluminium,* v. 36, no. 6, June 1956, p. 327-332.

Composition of shielding gas, physical properties and anodizability of welds, applications. Photographs, diagrams, table. (K1, Al)

340-K. The Influence of Welding in the Power and Process Industries. H. Harris. *British Welding Journal,* v. 3, June 1956, p. 233-241.

Welding in boiler construction, fabrication of valves, nuclear reactors, chemical engineering and oil industry applications. (K general)

341-K. Cold-Driven and Hot-Driven Titanium Rivets. *Convair, Report No.* 9536, May 1956, 17 p.

Mechanical properties of lap joints with cold and hot commercially pure titanium rivets. Fatigue life of sheet material into which they are driven. (K13, Q7 T7, Ti)

342-K. Fastening Devices for Sheet Metal. *Light Metals,* v. 19, June 1956, p. 183-184.

Drive rivets, rivnuts, Hishear rivets, Chobert rivets, break-off screw, self-sealing dome nut, Lamson place bolt, locking inserts. Diagrams. (K13)

343-K. Simple Soldering. *Modern Metals,* v. 12, June 1956, p. 64, 66.

Process joins aluminum, titanium, tantalum, stainless steel, glass, ceramics and other "unsolderable" materials without use of flux, surface cleaning or other pretreatment. (K7, SS, Ta, Ti, Al)

344-K. Brazing With Silver Alloys. *Steel,* v. 138, June 25, 1956, p. 80-83.

Composition, brazing temperatures, properties and uses of standard and special silver brazing alloys. (To be continued.) (K8, Ag, Cu, Zn)

345-K. The Why of Flux. A. M. Setapen and E. S. Chamer. *Steel,* v. 139, July 2, 1956, p. 80-82, 85.

Function, properties and composition of general-purpose flux for silver alloy brazing; properties of special fluxes. (K8, Ag)

346-K. Wrought Stainless-Steel Forms and Weldability. *Welding Engineer,* v. 41, June 1956, p. 63

Tabulated data on 25 stainless steels. (K9, S22, SS)

347-K. A Selection Guide for Methods of Submerged-Arc Welding. Robert A. Wilson. *Welding Journal,* v. 35, June 1956, p. 549-555.

Process selection, types of current, multiple arcs, type of control, power sources, special applications. (K1)

348-K. Mild-Steel Electrodes for Gas Metal-Arc Welding in Carbon Dioxide. Julian D. Carey and Robert D. Mann. *Welding Journal,* v. 35, June 1956, p. 556-559.

Killed and semikilled steel produce higher quality welds than rimmed steel using both carbon dioxide and argon-oxygen gases. (K1, ST)

349-K. How to Reclaim Plant and Machinery by Practical Welding Applications. G. Gordon Musted. *Welding Journal,* v. 35, June 1956, p. 560-567.

Oxy-acetylene, metal-arc and carbon-arc welding processes used to make many of the difficult repairs required by typical maintenance and reclamation applications. (K1, K2, ST)

350-K. Welding of Titanium. E. F. Gorman. *Welding Journal,* v. 35, June 1956, p. 575-580.

Techniques employed in the application of the inert-gas tungsten-arc process to the welding of titanium outside of atmosphere-controlled chambers. A practical test criterion for evaluating weld results. (K1, Ti)

351-K. Electrical and Metallurgical Characteristics of Mash Seam Welds. E. J. Funk and M. L. Begeman. *Welding Journal,* v. 35, June 1956, p. 265S-274S.

Relationship between mash seam welding variables and resultant characteristics of the weld. (K3)

352-K. High-Speed Fastener Production. Charles Palmer. *Western Machinery and Steel World,* v. 47, June 1956, p. 81-82.

A highly automatized and extremely self-sufficient production setup for fasteners that meet exacting standards of the aircraft industry. (K13)

353-K. (Czech.) **Flash-Resistance Butt Welding of Heat Resistant Steels and Carbon Steel.** O. Hajzler. *Strojirenstvi,* v. 6, no. 1, Jan. 1956, p. 36-39.

Properties of heat resistant steels. Mechanical and metallographic tests of a weld of a heat resistant with a carbon steel, and of two heat resistant steels. Economic advantages. (K3, Q general, M general, SS-h, CN)

354-K. (Czech.) **Welding of Anticorrosive, Columbium-Stabilized Steels for Use in Steam Turbines at 600° C.** Josef Nemec. *Zvaranie,* v. 5, no. 1, Jan. 5, 1956, p. 18-21.

Effect of initial ferrite content and various heat treatments on brittleness and notch toughness of welded metal. Causes, nature and prevention of internal stresses and cracking. (K1, J general, Q23, Q25, AY)

355-K. (Czech.) **Increasing Production by Argon-Shielded Welding.** Zdenek Bajer. *Zvaranie,* v. 5, no. 1, Jan. 5, 1956, p. 21-24.

Preparation of surfaces, polishing, preheating, current strength and welding time, types of electrodes, position of surfaces to be joined. (K1, Cu, Al)

356-K. (Czech.) **Concise Information About Several New Apparatuses for Submerged Arc Welding.** Jaromir Lukasek. *Zvaranie,* v. 5, no. 2, Feb. 2, 1956, p. 36-39.

Devices and machines for flux welding pipes to boilers. Manner of operation and types of motors used. Carbon-arc welding machine. (K1, ST, CN)

357-K. (Russian.) **Welding of Fine Thermocouples by Short Current Impulses.** A. G. Anikin. *Zhurnal Fizicheskoi Khimii,* v. 30, no. 3, Mar. 1956, p. 685-687.

Method for producing fine thermocouples without the inclusion of a third metal, as in the case of soldering, and with almost no widening at the junction. (K3, S16)

358-K. (Slovak.) **Epoxyde Resins as Metal Bonds.** Alfred Herman. *Zvaranie,* v. 5, no. 2, Feb. 2, 1956, p. 40-45.

Successful development of synthetic resins for bonding meant discarding costly pressure equipment and simplification of joining technology. (K12)

359-K. (Slovak.) **Deformations Arising in Welding and Methods of Preventing Them.** Ladislav Elias. *Zvaranie,* v. 5, no. 2, Feb. 2, 1956, p. 48-53.

Proper welding techniques, such as welding time, preparation of parts, position relation of parts to be joined, temperature control and choice of electrodes, for avoiding thermal deformations and internal stresses. (K general, Q25, ST, CN)

360-K. Carbon Dioxide for Welding. I. Allen F. Knight. *Canadian Metals,* v. 19, June 1956, p. 22, 24.

New methods of control and application put carbon dioxide ahead for use as inert gas. (To be continued.) (K1)

361-K. Fabrication of a Welded Steel Crankcase for a Large, 2-Cycle Diesel or Natural Gas Engine. Leo L. Young. *General Motors Engineering Journal,* v. 3, July-Sept. 1956, p. 22-27.

Submerged-arc welding techniques for a 9-ft. long, light-weight crankcase. (K1, AY)

362-K. Planned Welding Techniques Produce Quality Products. Dave Ritchie. *Industry & Welding,* v. 29, July, 1956, p. 52-54, 74-75.

Equipment and methods for resistance welding of copper sheet. (K3, Cu)

363-K. A Study on Low Temperature Brazing. II. Wetting by Droplet Method and Brazing Strength. Hitoshi Ishida and Shiro Yaji. *Journal of Mechanical Laboratory (Japan),* v. 1, 1955, p. 29-30.

The brazing droplet with greater wettability accelerates the alloying between solder and base metal, and consequently shows the higher brazing strength in a wider range of joint clearance. (K8)

364-K. Tips on Aluminum Joining. Frank Romano. *Light Metal Age,* v. 14, June 1956, p. 22-24.

Problems pertaining to heat conductivity and lack of heat color, use of fluxes, torch joining, joining thick sections. (K2, Al)

365-K. Fluxing Techniques. A. M. Setapen and E. S. Chamer. *Steel,* v. 139, July 9, 1956, p. 99-100.

Various brazing techniques applicable to pieces of different sizes and shapes on a production basis. (K8)

366-K. The Welding of a Small-Diameter, High-Pressure Gas Main. W. R. Garrett. *Welder,* v. 25, Jan.-Mar. 1956, p. 2-4.

Arc welding equipment and procedures. Economic factors. (K1, ST)

367-K. Soldered Stainless Resists Acid Corrosion. Herbert Drapkin. *Welding Engineer,* v. 41, July 1956, p. 29.

New stainless silver alloy has a melting point below 450° F. and can be applied with a soldering iron. (K7, R5, Ag, SS)

368-K. In Japan—Weldors Erect New T-1 Steel Vessels. Jack Fairlie. *Welding Engineer,* v. 41, July, 1956, p. 30-31.

Two 110-ft. diam. vessels with an operating pressure of 71 psi. were built, using a high-strength, low-alloy steel, with a minimum yield of 90,000 psi. and good weldability. (K1, K9, T29, AY)

369-K. Welding. . .for Sanitary Seals of Stainless. F. T. Tancula. *Welding Engineer,* v. 41, July 1956, p. 32-34.

Welding techniques applied to fabrication of dairy and food-processing equipment. (K1, SS)

370-K. Points to Remember When Soldering Copper Tube. Arthur I. Heim. *Welding Engineer,* v. 41, July 1956. p. 37-39.

Solder selection, flux requirements, preparing the work, judging proper heat, testing soldered joints. (K7, Cu)

371-K. Proper Tooling Creates Savings on Inert Gas in Titanium Welding. *Welding Engineer,* v. 41, July 1956, p. 40-41.

"Chill-shunt" tooling method produces bright welds with no sign of oxidation, without the use of inert gas backing. (K1, Ti)

Industrial Heating, v. 23, June 1956, p. 1161 + 4 pages.

Five different heating methods used to satisfy annealing requirements for copper wire. (To be continued.) (J22, F28, Cu, Al)

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A review with some typical examples. (J general)

193-J. Deep Freeze Your Casting for Stress Relief. *Precision Metal Molding,* v. 14, July 1956, p. 51-52.

Pent-up stresses that would distort the casting ordinarily are relieved by freezing. Machining is simplified. (J1, J26, Al)

194-J. (Czech.) **Stepwise Flame Hardening of Gears.** A. Strachota. *Strojirenska Vyroba,* v. 1, no. 4, Apr. 1956, p. 21-26.

New Czech instrument has heating tip that fits down along each individual gear tooth. The advantage is a very even depth of hardening for crest and trough of each tooth, while the core of the tooth still remains tough. Method results in better fatigue limits and less brittleness. Design and operation features. (J2, ST)

195-J. (Czech.) **Equipment and Techniques for Induction Heating.** J. Paukner. *Strojirenska Vyroba,* v. 4, no. 2, Feb. 1956, p. 70-76.

Survey of Czech and Soviet instruments, machines and techniques for induction heating, hardening, annealing, forging operations and welding and similar operations. (J2)

196-J. (Russian.) **Effective Procedures for Quench-Hardening Large Forgings of Structural Steel.** A. A. Astaf'ev and K. A. Ermakov. *Metallovedenie i Obrabotka Metallov,* 1956, no. 4, Apr. 1956, p. 35-45.

Mechanical properties of the steel in relation to temperature and time of isothermal transformation. Kinetics to transformation of supercooled austenite. Quenching temperatures and media. (J26, N8, Q general, AY-n)

197-J. (Russian.) **Induction Heating of Intermediate Products of Heat-Resistant Alloy EI437 for Die Stamping.** I. I. Bezruchko, Ia. M. Ditiatkovskii and M. S. Aizikovich. *Metallovedenie i Obrabotka Metallov,* 1956, no. 4, Apr. 1956, p. 58-60.

Current frequency, heating temperature, depth of current penetration and other factors in heating of alloy from which turbine blades are to be stamped. (J2, SS-h)

198-J. (Russian.) **Determination of Hardenability of Chromium-Manganese Tool Steel.** V. V. Polovnikov. *Zavodskaia Laboratoriia,* v. 22, no. 5, May 1956, p. 565-567.

Quantitative relationship between stability of austenite in, and hardenability characteristics of, toolsteel. Problem of uniformity of methods involved in determination of each of these properties. (J26, N8, TS)

K Joining

327-K. Welding of Thick Plates of Bureau of Mines Zirconium. D. C. Martin, R. D. Williams and C. B. Voldrich. *Battelle Memorial Institute (U. S. Atomic Energy Commission),* AECD-3863, July 1950, 42 p.

The inert-gas-shielded tungsten-arc process for welding zirconium, using helium as the shielding gas, was satisfactory. Welding had to be done in a controlled atmosphere chamber to prevent high weld hardnesses, and crystal-bar filler metal had to be used. Photographs, micrographs, graphs, diagrams, tables. (K1, Zr)

328-K. Furnace Brazing of Titanium. L. D. Girton. *Convair, Report No.* 7957 Add. 1, Mar. 1954, 4 p.

Strength, ductility and corrosion resistance of lap joints in 0.025 RC70 titanium, furnace brazed with fine silver. Table, diagrams. (K8, Ti)

329-K. Which Welding Process? G. F. W. Barrett. *Industry & Welding,* v. 29, June 1956, p. 58 + 6 pages.

Cost of joint preparation, direct labor costs and general overhead charges for various arc processes and oxy-acetylene welding. Tables. (K1, K2)

330-K. Resistance Welding High Temperature Alloys. P. M. Howard and D. Wilcox. *Industry & Welding,* v. 29, June 1956, p. 66 + 5 pages.

Conditions for welding, importance of proper cooling during stitch welding, welding dissimilar materials and production quality control. Photographs. (K3, SG-h)

331-K. Weld Aluminum Two Ways in Mass Production Setup. L. W. Kunkler. *Iron Age,* v. 177, June 7, 1956, p. 122-123.

Mass production of 13-ft. long aluminum fire bombs depends on a lineup of 20 manual and semi-automatic welding stations, using gas-shielded tungsten and metal arc methods. Photographs. (K1, Al)

332-K. Braze Strong Joints With Self-Fluxing Alloys. D. A. Canonico, Nicholas Bredzs and Harold Schwartzbart. *Iron Age,* v. 177, June 14, 1956, p. 98-99.

New lithium-bearing alloys join metals like stainless, nickel and cobalt-base alloys without use of reducing atmosphere. Joint strength is high, without voids or tendency to corrode. Photographs. (K8, SS, Ni, Co)

333-K. Welding Clad Steel. William H. Funk. *Iron and Steel Engineer,* v. 33, May 1956, p. 104-107.

Quality workmanship in fabrication pays off in economical vessels and weldments which meet their design requirements. Principles and procedures for welding. Diagrams, photographs. (K1, K2, ST)

334-K. Inert Atmosphere Welding of Zirconium and Hafnium. J. S. Theilacker, E. D. Baugh, A. H. Kasberg and R. B. Stermon. *Journal of Metals,* v. 8, May 1956, p. 646-647.

Low thermal expansivity and very small volume change associated with phase transformations permit welding of complex structures with minimum of distortion. Equipment and procedures. Diagram, photograph. (K1, Zr, Hf)

335-K. Designing for Soldered Joints. J. B. Mohler. *Machine Design,* v. 28, June 14, 1956, p. 123-128.

Basic design and application considerations, alloy and fluxes, requirements of the soldering process, joint strength and solderability of metals. Diagrams, graphs, tables. (K7)

336-K. The Welding of Titanium. R. Fannon. *Welding and Metal Fabrication,* v. 24, June 1956, p. 192-193.

The inert-gas arc welding processes, argon-arc and Argonaut, are eminently suited to the fusion welding of titanium. Photographs, diagram, table. (K1, Ti)

337-K. Welding Shows Adaptability in Rocket Fabrication. Francis H. Stevenson. *Welding Engineer,* v. 41, June 1956, p. 32-34.

Techniques used on titanium and stainless steel; fixture design. Photographs. (K1, SS, Ti)

338-K. Uses Expand as 200-Series Stainless Passes Weldability Tests. *Welding Engineer,* v. 41, June 1956, p. 40-42, 44.

Physical properties, weldability tests, welding conditions, production outlook. Photographs, tables. (K9, Q23, SS)

339-K. (German.) **Shielded Arc Welding of Light Metals.** W. Mantel and L. Wolff. *Aluminium,* v. 36, no. 6, June 1956, p. 327-332.

Composition of shielding gas, physical properties and anodizability of welds, applications. Photographs, diagrams, table. (K1, Al)

340-K. The Influence of Welding in the Power and Process Industries. H. Harris. *British Welding Journal,* v. 3, June 1956, p. 233-241.

Welding in boiler construction, fabrication of valves, nuclear reactors, chemical engineering and oil industry applications. (K general)

341-K. Cold-Driven and Hot-Driven Titanium Rivets. *Convair, Report No.* 9536, May 1956, 17 p.

Mechanical properties of lap joints with cold and hot commercially pure titanium rivets. Fatigue life of sheet material into which they are driven. (K13, Q7 T7, Ti)

342-K. Fastening Devices for Sheet Metal. *Light Metals,* v. 19, June 1956, p. 183-184.

Drive rivets, rivnuts, Hishear rivets, Chobert rivets, break-off screw, self-sealing dome nut, Lamson place bolt, locking inserts. Diagrams. (K13)

343-K. Simple Soldering. *Modern Metals,* v. 12, June 1956, p. 64, 66.

Process joins aluminum, titanium, tantalum, stainless steel, glass, ceramics and other "unsolderable" materials without use of flux, surface cleaning or other pretreatment. (K7, SS, Ta, Ti, Al)

344-K. Brazing With Silver Alloys. *Steel,* v. 138, June 25, 1956, p. 80-83.

Composition, brazing temperatures, properties and uses of standard and special silver brazing alloys. (To be continued.) (K8, Ag, Cu, Zn)

345-K. The Why of Flux. A. M. Setapen and E. S. Chamer. *Steel,* v. 139, July 2, 1956, p. 80-82, 85.

Function, properties and composition of general-purpose flux for silver alloy brazing; properties of special fluxes. (K8, Ag)

346-K. Wrought Stainless-Steel Forms and Weldability. *Welding Engineer,* v. 41, June 1956, p. 63

Tabulated data on 25 stainless steels. (K9, S22, SS)

347-K. A Selection Guide for Methods of Submerged-Arc Welding. Robert A. Wilson. *Welding Journal,* v. 35, June 1956, p. 549-555.

Process selection, types of current, multiple arcs, type of control, power sources, special applications. (K1)

348-K. Mild-Steel Electrodes for Gas Metal-Arc Welding in Carbon Dioxide. Julian D. Carey and Robert D. Mann. *Welding Journal,* v. 35, June 1956, p. 556-559.

Killed and semikilled steel produce higher quality welds than rimmed steel using both carbon dioxide and argon-oxygen gases. (K1, ST)

349-K. How to Reclaim Plant and Machinery by Practical Welding Applications. G. Gordon Musted. *Welding Journal,* v. 35, June 1956, p. 560-567.

Oxy-acetylene, metal-arc and carbon-arc welding processes used to make many of the difficult repairs required by typical maintenance and reclamation applications. (K1, K2, ST)

350-K. Welding of Titanium. E. F. Gorman. *Welding Journal,* v. 35, June 1956, p. 575-580.

Techniques employed in the application of the inert-gas tungsten-arc process to the welding of titanium outside of atmosphere-controlled chambers. A practical test criterion for evaluating weld results. (K1, Ti)

351-K. Electrical and Metallurgical Characteristics of Mash Seam Welds. E. J. Funk and M. L. Begeman. *Welding Journal,* v. 35, June 1956, p. 265S-274S.

Relationship between mash seam welding variables and resultant characteristics of the weld. (K3)

352-K. High-Speed Fastener Production. Charles Palmer. *Western Machinery and Steel World,* v. 47, June 1956, p. 81-82.

A highly automatized and extremely self-sufficient production setup for fasteners that meet exacting standards of the aircraft industry. (K13)

353-K. (Czech.) **Flash-Resistance Butt Welding of Heat Resistant Steels and Carbon Steel.** O. Hajzler. *Strojirenstvi,* v. 6, no. 1, Jan. 1956, p. 36-39.

Properties of heat resistant steels. Mechanical and metallographic tests of a weld of a heat resistant with a carbon steel, and of two heat resistant steels. Economic advantages. (K3, Q general, M general, SS-h, CN)

354-K. (Czech.) **Welding of Anticorrosive, Columbium-Stabilized Steels for Use in Steam Turbines at 600° C.** Josef Nemec. *Zvaranie,* v. 5, no. 1, Jan. 5, 1956, p. 18-21.

Effect of initial ferrite content and various heat treatments on brittleness and notch toughness of welded metal. Causes, nature and prevention of internal stresses and cracking. (K1, J general, Q23, Q25, AY)

355-K. (Czech.) **Increasing Production by Argon-Shielded Welding.** Zdenek Bajer. *Zvaranie,* v. 5, no. 1, Jan. 5, 1956, p. 21-24.

Preparation of surfaces, polishing, preheating, current strength and welding time, types of electrodes, position of surfaces to be joined. (K1, Cu, Al)

356-K. (Czech.) **Concise Information About Several New Apparatuses for Submerged Arc Welding.** Jaromir Lukasek. *Zvaranie,* v. 5, no. 2, Feb. 2, 1956, p. 36-39.

Devices and machines for flux welding pipes to boilers. Manner of operation and types of motors used. Carbon-arc welding machine. (K1, ST, CN)

357-K. (Russian.) **Welding of Fine Thermocouples by Short Current Impulses.** A. G. Anikin. *Zhurnal Fizicheskoi Khimii,* v. 30, no. 3, Mar. 1956, p. 685-687.

Method for producing fine thermocouples without the inclusion of a third metal, as in the case of soldering, and with almost no widening at the junction. (K3, S16)

358-K. (Slovak.) **Epoxyde Resins as Metal Bonds.** Alfred Herman. *Zvaranie,* v. 5, no. 2, Feb. 2, 1956, p. 40-45.

Successful development of synthetic resins for bonding meant discarding costly pressure equipment and simplification of joining technology. (K12)

359-K. (Slovak.) **Deformations Arising in Welding and Methods of Preventing Them.** Ladislav Elias. *Zvaranie,* v. 5, no. 2, Feb. 2, 1956, p. 48-53.

Proper welding techniques, such as welding time, preparation of parts, position relation of parts to be joined, temperature control and choice of electrodes, for avoiding thermal deformations and internal stresses. (K general, Q25, ST, CN)

360-K. Carbon Dioxide for Welding. I. Allen F. Knight. *Canadian Metals,* v. 19, June 1956, p. 22, 24.

New methods of control and application put carbon dioxide ahead for use as inert gas. (To be continued.) (K1)

361-K. Fabrication of a Welded Steel Crankcase for a Large, 2-Cycle Diesel or Natural Gas Engine. Leo L. Young. *General Motors Engineering Journal,* v. 3, July-Sept. 1956, p. 22-27.

Submerged-arc welding techniques for a 9-ft. long, light-weight crankcase. (K1, AY)

362-K. Planned Welding Techniques Produce Quality Products. Dave Ritchie. *Industry & Welding,* v. 29, July, 1956, p. 52-54, 74-75.

Equipment and methods for resistance welding of copper sheet. (K3, Cu)

363-K. A Study on Low Temperature Brazing. II. Wetting by Droplet Method and Brazing Strength. Hitoshi Ishida and Shiro Yaji. *Journal of Mechanical Laboratory (Japan),* v. 1, 1955, p. 29-30.

The brazing droplet with greater wettability accelerates the alloying between solder and base metal, and consequently shows the higher brazing strength in a wider range of joint clearance. (K8)

364-K. Tips on Aluminum Joining. Frank Romano. *Light Metal Age,* v. 14, June 1956, p. 22-24.

Problems pertaining to heat conductivity and lack of heat color, use of fluxes, torch joining, joining thick sections. (K2, Al)

365-K. Fluxing Techniques. A. M. Setapen and E. S. Chamer. *Steel,* v. 139, July 9, 1956, p. 99-100.

Various brazing techniques applicable to pieces of different sizes and shapes on a production basis. (K8)

366-K. The Welding of a Small-Diameter, High-Pressure Gas Main. W. R. Garrett. *Welder,* v. 25, Jan.-Mar. 1956, p. 2-4.

Arc welding equipment and procedures. Economic factors. (K1, ST)

367-K. Soldered Stainless Resists Acid Corrosion. Herbert Drapkin. *Welding Engineer,* v. 41, July 1956, p. 29.

New stainless silver alloy has a melting point below 450° F. and can be applied with a soldering iron. (K7, R5, Ag, SS)

368-K. In Japan—Weldors Erect New T-1 Steel Vessels. Jack Fairlie. *Welding Engineer,* v. 41, July, 1956, p. 30-31.

Two 110-ft. diam. vessels with an operating pressure of 71 psi. were built, using a high-strength, low-alloy steel, with a minimum yield of 90,000 psi. and good weldability. (K1, K9, T29, AY)

369-K. Welding. . .for Sanitary Seals of Stainless. F. T. Tancula. *Welding Engineer,* v. 41, July 1956, p. 32-34.

Welding techniques applied to fabrication of dairy and food-processing equipment. (K1, SS)

370-K. Points to Remember When Soldering Copper Tube. Arthur I. Heim. *Welding Engineer,* v. 41, July 1956, p. 37-39.

Solder selection, flux requirements, preparing the work, judging proper heat, testing soldered joints. (K7, Cu)

371-K. Proper Tooling Creates Savings on Inert Gas in Titanium Welding. *Welding Engineer,* v. 41, July 1956, p. 40-41.

"Chill-shunt" tooling method produces bright welds with no sign of oxidation, without the use of inert gas backing. (K1, Ti)

372-K. Aluminum-Wound Step Regulators Can be Tig Welded. C. W. Nielsen. *Welding Engineer,* v. 41, July 1956, p. 75-76.

High-frequency tungsten inert-gas welding, with helium as a shield, provides an excellent electrical and mechanical connection between aluminum parts. Use of helium as shielding gas prevents oxidation. (K1, Al)

373-K. (French.) **"Riv-Clé"-Rivets and the Joining of Sheets Accessible Only on One Side. II. Rivet Guns.** B. Adaridi. *Revue de l'Aluminium,* v. 33, no. 231, Apr. 1956, p. 403-407.

Types of simple manual apparatus and semi-automatic air and oil-driven tools for positioning small or large rivets. (K13, Al)

374-K. (Italian.) **Technology of Soldering and Brazing. Filler Materials and Fluxes.** Mario Macuz. *Tecnica Italiana,* v. 21, no. 3, Apr.-May 1956, p. 165-171.

Scientific and technological aspects of the two processes. (K7, K8)

375-K. (Russian.) **New High-Conductivity Copper Alloys for Resistance Welding Electrodes.** M. V. Zakharov. *Metallovedenie i Obrabotka Metallov,* 1956, no. 5, May 1956, p. 2-11.

Influence of various additives on the electric conductivity and heat resistance of copper. Composition, properties and uses of certain new copper alloys employed in resistance welding. (K3, P15, Cu)

376-K. (Book.) **Proceedings of the Conference on Welded Structures.** 315 p. 1954. Her Majesty's Stationery Office, London, England. $7.20.

Stress analysis, design and welding procedures for ships, buildings, dock gates, caissens, bridges, oil and gas storage vessels and tubular structures. (K1, Q25, ST)

L

Cleaning, Coating and Finishing

491-L. Surface Preparation of Steel. I. Joseph Bigos. *Chemistry in Canada,* v. 8, May 1956, p. 30-34.

Complete descaling by blast cleaning or pickling and a suitable pretreatment is the optimum surface preparation. For mild atmospheres, wire brushing is adequate and economical since intact mill scale under such conditions is a good basis for paint. Tables, photographs. (L10, L26, ST)

492-L. Anodic Oxide Films. V. Kinetics of Formation of Anodic Oxide Films on Niobium. Space Charge and the Tafel Slope Anomaly. VI. Application of Dewald's Theory to Niobium. Lawrence Young. *Faraday Society, Transactions,* v. 52, Apr. 1956, p. 502-521.

Anodic polarization of columbium produces interference-colored oxide films similar to those on tantalum. Film growth involves the passage of a current of metal ions through the film under the influence of the electrostatic field set up in the oxide by the applied voltage. The Dewald theory is considered to account for the anomaly in the temperature dependence of the Tafel slope with tantalum. Graphs, tables, diagrams. 18 ref. (L19, Cb)

493-L. How You Can Blacken Stainless Steel. W. E. McFee. *Finish,* v. 13, June 1956, p. 27-28.

Proper cleaning and immersion in molten bath of dichromates results in a smooth, durable and corrosion resistant oxide film. Photograph, graph. (L14, SS)

494-L. Developments in Scalebreaking and Continuous Pickling Lines. J. I. Greenberger. *Iron and Steel Engineer,* v. 33, May 1956, p. 69-76; disc., p. 76-79.

Application of scalebreaker gives increased productivity with minimum acid immersion length; acid requirements are reduced, strip speeds are increased and costs are reduced; existing lines can be converted to use the equipment. Table, photographs, graphs, diagrams, nomograph. (L10, L12, ST)

495-L. Chemical Polishing of Pure Zinc. J. J. Gilman and V. J. DeCarlo. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 511-512.

New polish consists of three chemicals: nitric acid, ethyl alcohol, and hydrogen peroxide. Diagram. 4 ref. (L12, Zn)

496-L. Sublimation Figures in Nickel, Copper, and Zinc. J. C. Danko and A. J. Griest. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 515-516.

Sublimation figures on evaporated coatings were cubic for nickel, hexagonal for zinc and circular for copper. Graph, micrographs. 3 ref. (L25, M27, Ni, Cu, Zn)

497-L. New Titanate Coatings. Robert J. Fabian. *Materials & Methods,* v. 43, June 1956, p. 120-122.

Among the advantages of butyl titanate-based paints are excellent heat and corrosion resistance. Graph, table, photographs. 5 ref. (L26, Ti)

498-L. Cost Factors Governing Buff Selection. Edwin Dolye. *Metal Finishing,* v. 54, June 1956, p. 75-76.

Costs of labor, compound, buff, power, supervision and maintenance; machine down time; set-up and break-in time; machine depreciation; fixed overhead; cost of salvaging rejects. Table (L10)

499-L. Surface Treatment and Finishing of Light Metals. VIII. Hard Anodizing. S. Wernick and R. Pinner. *Metal Finishing,* v. 54, June 1956, p. 82-87.

Properties and applications of hard anodic coatings. Micrographs, tables, photographs, graph. 17 ref. (L19, Al)

500-L. Barrel Finishing. Charles E. Kincaid. *Metal Industry,* v. 88, June 1, 1956, p. 458-460.

Principles, grinding compounds, types of media, processing loose parts and multiple compartment barrels. Photographs, diagrams. (To be continued.) (L10)

501-L. Descaling Steel Sheet by Shot-Blasting. Wilhelm Olson. *Metal Progress,* v. 69, June 1956, p. 66-67.

Shot-blast descaling of hot rolled low-carbon steel sheet and strip has not only relieved a procurement problem but has also reduced costs. Photographs. (L10, CN)

502-L. Metallizing. Norman E. Rawson. *Northwestern Engineer,* v. 15, June 1956, p. 18-19, 40.

Development, equipment, operating procedures and applications. Diagram, photograph. (L23)

503-L. Pipe Line Coating Practices. Alex McClure. *Pipe Line News,* v. 28, June 1956, p. 41-42, 44-47.

Some factors associated with the selection and application of pipeline coatings; cost summary. (L26)

504-L. Characteristics of Controlled Rinse Tanks. J. B. Mohler. *Plating,* v. 43, June 1956, p. 732-737.

Solubridge controller reduces water costs. Rapid readings obtained by the conductivity method are used to determine most practical rinse concentrations. Tables, graphs, diagram. 4 ref. (L12, L17)

505-L. How to Buy a Tumbling Barrel. William E. Brandt and David W. Stitely. *Plating,* v. 43, June 1956, p. 738-742.

Recommendations concerning the drum, motor and drive units, shaft, bearing and framework, size, speed and horsepower, safety provisions. Photographs. (L10)

506-L. Polishing and Buffing of Die Castings. *Precision Metal Molding,* v. 14, June 1956, p. 59-63, 65.

Designing for polishing, equipments and materials, recommended cycles. Table, photographs. (L10)

507-L. New Non-Electrolytic Plating Process. *Precision Metal Molding,* v. 14, June 1956, P. 66-68.

Kanigen process deposits a uniform, hard, nonporous coating of nickel-phosphorus on iron, copper or aluminum and their alloys from a chemical bath without the use of electricity. Micrograph, table, photographs. (L14, Ni)

508-L. Plastisol Coating of Wire Products. Gerard H. Poll, Jr. *Product Finishing,* v. 20, June 1956, p. 66-70, 72.

Equipment and operating procedures and fume removal. Photographs. (L26)

509-L. Barrel Finishing Principles. H. Leroy Beaver. *Product Finishing,* v. 20, June 1956, p. 76-78.

Historical outline and types of barrels. (L10)

510-L. Gear "Burring" by "Electrolytic Polishing". I. "Electrolytic Burring" of Aluminium Gears. Masao Naruse and Akira Nannichi. *Technology Reports Tohoku University,* v. 20, 1956, p. 225-233.

Polishing was carried out in phosphoric acid solution of 1.4 density, with the gear as the anode connected in parallel with an aluminum plate cathode. Micrographs, photographs, graphs, diagrams. (L13, Al)

511-L. Metalizing Helps Lick Gulf Coast Corrosion. F. W. Gartner, Jr. *World Oil,* v. 142, June 1956, p. 220, 225.

Excellent protection easily applied at a low cost per year makes metalizing a useful tool in corrosion prevention. Photographs. (L23)

512-L. Automatic Plating Setup Processes Variety of Castings. *Automation,* v. 3, July 1956, p. 52-54.

Cleaning operations, automatic plating equipment and procedures. (L17)

513-L. How We Got Where We Are in Light-Metal Enameling. II. Paul A. Huppert. *Ceramic Industry,* v. 67, July 1956, p. 64-65, 97-98.

An historical review of literature. (To be continued.) (L27, Al)

514-L. Recent Developments in Rubber Lining. R. F. Reynolds. *Chemical & Process Engineering,* v. 37, June 1956, p. 195-198, 210.

Advances in the use of rubber linings for tanks, vessels, pipes and other items of chemical plant. (L26)

515-L. The Cathode Polarization Potential of Silver in Silver Nitrate. I. The Effect of Organic and Inorganic Additives. E. G. Neal and L. L. Shreir. *Faraday Society, Transactions,* v. 52, May 1956, p. 703-712.

An absorption theory explains

both the polarization potentials and the mechanism of action of addition agents. (L17, Ag)

516-L. Standardized Barrel Tumbling Pays Off. *Iron Age,* v. 177, June 21, 1956, p. 115-117.

Barrel finishing of small ferrous parts. (L10, ST, CI)

517-L. How to Get More for Your Finishing Dollar. I. Plating. II. Metal Cleaning and Finishing Handbook. *Iron Age,* v. 177, June 28, 1956, p. 98-128.

Management's duties, plant layout and maintenance, product design, water supply, plating wastes. Tabular information to help in selecting, evaluating and specifying the right cleaning or finishing method for a particular use. (L general)

518-L. Barrel Finishing. Charles E. Kincaid. *Metal Industry,* v. 88, June 8, 1956, p. 477-478.

Recommendations for successful finishing. Maximum utilization of process can be secured only on volume production of parts. (L10)

519-L. Lithography on Aluminum Foil. Don Pingree. *Pacific Printer, Publisher, and Lithographer,* v. 94, June 1956, p. 12, 14.

Improvements in foil, ink and laminating process increase applications. (L26, Al)

520-L. Improved Finishes for Metals. Polytetrafluoroethylene Dispersions. Evaluation of Paint Durability. The Painting of Magnesium Alloy Surfaces. E. M. Elliott, T. R. Bullett and W. F. Higgins. *Paint Manufacture,* v. 26, June 1956, p. 201-205.

Summaries of three papers on polytetrafluorethylene dispersions, accelerated weathering tests and painting of magnesium alloy surfaces. Role of coatings in protection against hard use, corrosion and weathering is emphasized. (L26)

521-L. Research and Development. Anti-Corrosive and Marine Paints. Plant and Equipment. *Paint Manufacture,* v. 26, June 1956, p. 215-218.

Cathodic protection, types of paints and primers. Pipelines, material handling, instrumentation, milling and mixing pumps. (L26, R10, A5)

522-L. Flame Plating Coating Process Grows as Production Method. *Western Metals,* v. 6, June 1956, p. 66-68.

Applications, advantages and procedures. (L23)

523-L. Plastisols Penetrate Pores of Western Metal Products. Donald B. Barber. *Western Metals,* v. 6, June 1956, p. 72-73.

Thick, single-coat dry films are produced with standard spraying equipment, and can be applied at room temperature to cold, vertical surfaces in thicknesses of 0.09-in. without sagging. (L26)

524-L. (German.) **Inhibiting Effect of Aluminum in Pot Galvanization on Formation of Iron-Zinc Alloy Layers.** Diedrich Horstmann. *Archiv für das Eisenhüttenwesen,* v. 27, no. 5, May 1956, p. 297-302.

Effect of temperature and aluminum content of the zinc smelt. Evaluation. (L16, Al, Fe, Zn)

525-L. (German.) **Modern Galvanic Deposition Processes.** E. Roth. *Metall,* v. 10, nos. 11-12, June 1956, p. 505-513.

Advantages and disadvantages of galvanic baths with a special consideration of corrosion. Improvement of processes. (L16, R1)

526-L. (German.) **Rust-Preventing Coatings.** I. K. A. van Oeteren-Panhäuser. *Metalloberfläche,* v. 10, no. 6, June 1956, p. 167-173.

General survey of rust prevention problems. Properties of coatings, mechanism of their action, need for multiple coats, methods of application. (L general)

527-L. (Russian.) **Some Questions Concerning the Theory of the Electrodeposition of Alloys. I. Methods of Calculating the Potential Shift of Ionic Discharge Due to the Mixing Energy on Formation of the Alloy.** Yu. M. Polukarov and K. M. Gorbunova. *Zhurnal Fizicheskoi Khimii,* v. 30, no. 3, Mar. 1956, p. 515-521.

Shift may be calculated from thermochemical data or from data on free energy changes obtained from measurements in the vapor pressures of the components of the given system or from data on the electromotive force of the correspondingly constructed cell. (L17)

528-L. (Russian.) **Suppression of Structural Etching During Electrochemical Polishing.** S. I. Krichmar and V. P. Galushko. *Zhurnal Fizicheskoi Khimii,* v. 30, no. 3, Mar. 1956, p. 577-580 + 2 plates.

It was shown, with copper as example, that the electropolishing of a pure metal occurs with practically complete inhibition of etching, the surface graining only at comparatively low potentials. (L13, Cu)

529-L. Surface Preparation of Steel. II. Joseph Bigos. *Chemistry in Canada,* v. 8, June 1956, p. 66-70.

Solvent cleaning, steam cleaning, acid cleaning, chipping, wirebrushing, flame cleaning and sand blasting. (L10, L12, ST)

530-L. A Study of Whisker Formation in the Electrodeposition of Copper. P. A. Van Der Meulen and H. V. Lindstrom. *Electrochemical Society, Journal,* v. 103, July 1956, p. 390-395.

Possible mechanisms involved in electrolytic copper filament formation and its prevention, reasonable hypothesis to explain the process. (L17, M26, Cu)

531-L. Deposition of Titanium From Titanium-Oxygen Alloys on Copper, Iron, and Mild Steel. S. T. Shih, M. E. Straumanis and A. W. Schlechten. *Electrochemical Society, Journal,* v. 103, July 1956, p. 395-400.

Thick and corrosion resistance coatings on ingot iron, mild steels and other metals can be obtained by treating them under an inert gas in fused salt baths containing a titanium-oxygen alloy high in titanium content, and as large an amount of such alloy as possible without sacrificing the fluidity of the bath. (L17, ST, Cu, Fe, Ti)

532-L. Research on the Surface Treatment of Die-Cast Zinc. II. On the Method of Electropolishing. Matsuhei Kishi. *Journal of Mechanical Laboratory (Japan),* v. 1, 1955, p. 31-32.

Electropolishing is useful as a preliminary treatment for electroplating of die-cast zinc, though not suitable for final surface treatment. (L13, E13, Zn)

533-L. Barrel Finishing in a Job Plating Plant. *Precision Metal Molding,* v. 14, July 1956, p. 54-57.

Chip and compound selection, barrel operation, influence of casting quality, application of barrel finishing. (L10, L17)

534-L. Ultracleaning With Ultrasonics. *Steel,* v. 139, July 9, 1956, p. 90-91.

Equipment and operation of automated, high-speed cleaning line with an integral ultrasonic chamber for scrubbing steering gear parts. (L10)

535-L. Electrodeposition of Titanium. W. Reid, A. Gaudette, A. Brenner and J. Connor. *U. S. Department of Commerce, National Bureau of Standards Report* 4148 and 4346. Progress Reports Apr. to June, and July to Sept. 1955, 8 p. and 6 p.

Preparation of new organotitanium compounds suitable for use in plating baths was attempted. These include primarily titanium alkyl derivates and carbonyl titanium compounds. No successful plating baths were obtained. (L17, Ti)

536-L. (Russian.) **Aluminum Diffusion Coating of Gas-Turbine Blades of Austenitic Steels.** V. I. Prosvirin, A. I. Fedosov and Iu. S. Miakishev. *Metallovedenie i Obrabotka Metallov,* 1956, no. 4, Apr. 1956, p. 50-56.

Methods for applying aluminum and aluminum-chromium diffusion coatings. Microhardness and erosion tests of coated and uncoated blades, and of blades with aluminum coating plus quenching and tempering. (L15, Q9, Q29, T25, AY, Al, Cr)

M

Metallography, Constitution and Primary Structures

262-M. The Equilibrium Diagram of the System Antimony-Tin. E. C. Ellwood. *Institute of Metals, Annotated Equilibrium Diagrams,* No. 23, Apr. 1956, 5 p.

The most probable composite diagram is given along with numerical data. Table, diagram. 16 ref. (M24, Sb, Sn)

263-M. The Lattice Spacings of Nickel-Copper and Palladium-Silver Alloys. B. R. Coles. *Institute of Metals, Journal,* v. 84, May 1956, p. 346-348.

Total changes in spacing (at room temperature) discussed in terms of theories of the contributions of the *d*-bands to the cohesion. Graphs, tables. 12 ref. (M26, Ni, Cu, Pd, Ag)

264-M. A Note on the Plotting of Accurate Large-Scale Stereographic Projections. J. W. Christian. *Institute of Metals, Journal,* v. 84, May 1956, p. 349-350.

Projections of crystallographic planes may be readily plotted in terms of linear co-ordinates with a minimum of calculation. Diagram. 5 ref. (M23)

265-M. Surface Examination by Reflection Electron Microscopy. J. S. Halliday. *Institution of Mechanical Engineers, Proceedings,* v. 169, no. 38, 1955, p. 777-781 + 4 plates; disc., p. 782-787 + 6 plates.

Method is particularly suitable for examination of surfaces on which irregularities are small. Micrographs of various metals show that ground surfaces of comparable roughness may have different textures and these differences appear to be related to mechanical properties. Tables, micrographs, photographs, diagrams. 14 ref. (M21)

266-M. Covergent-Beam X-Ray Analysis of Mosaic Structure in Polycrystals. Chester R. Berry. *Journal of*

Applied Physics, v. 27, June 1956, p. 636-639.

A simple X-ray diffraction method was used to measure mosaic misalignment and number of dislocations in grains of silver halide precipitates and of nickel foils where grain sizes were in the range from a few tenths of a micron to a few microns. Photographs, table, diagram. 11 ref. (M22, M26, Ni)

267-M. Substructures in Retained-Beta Phase of Ti-Ni Alloys. D. H. Polonis and J. Gordon Parr. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 514-515.

Microstructures of 100% β phase in a quenched 6 at. % nickel alloy were examined. Micrographs. (M27, Ti, Ni)

268-M. High Temperature X-Ray Diffraction Investigation of the Zr-H System. D. A. Vaughan and J. R. Bridge. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 528-531.

The phase diagram over the range 0 to 65 at. % was determined by high-temperature X-ray diffraction methods. Results show a eutectoid between α-zirconium and the hydride phase. Tables, graphs. 6 ref. (M26, M22, M24, Zr)

269-M. Magnesium-Uranium System. P. Chiotti, G. A. Tracy and H. A. Wilhelm. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 562-567.

A summary of analytical, X-ray, thermal and metallographic data. No intermetallic compounds are formed by these two elements, and their mutual solubility is limited at temperatures up to 1255° C. Tables, micrographs, diagrams. 9 ref. (M24, Mg, U)

270-M. Re-Examination of Ti-Fe and Ti-Fe-O Phase Relations. Elmars Ence and Harold Margolin. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 572-577.

Re-examination points to the existence of Ti_2Fe, which forms by peritectoid reaction between β and TiFe in the vicinity of 1000° C., and indicates the presence of two ternary phases, γ and ε. Diagrams, micrographs, tables. 16 ref. (M24, Fe, Ti)

271-M. Cubic Texture in Ultrathin Tapes of 48 Pct Ni-Fe Alloy. Martin F. Littman. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 593-595.

Orientations and magnetic properties determined. Table, stereograms. 3 ref. (M26, P16, Ni, Fe)

272-M. Titanium-Molybdenum-Oxygen System. Paul A. Farrar, Louis P. Stone and Harold Margolin. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 595-600.

Alloy preparation, homogenization and heat treatment, metallography, X-ray diffraction, melting points, phase diagram delineation. Tables, diagrams, graphs, micrographs. 19 ref. (M24, Ti, Mo)

273-M. Contribution to the Bi-Mn System. A. U. Seybolt, H. Hansen, B. W. Roberts and P. Yurcisin. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 606-610.

The bismuth-manganese phase diagram in the region near BiMn was investigated, using principally thermal analysis and changes in magnetization with temperature. Micrographs, graphs, tables, diagram. 8 ref. (M24, Bi, Mn)

274-M. The Crystal Structure of Gamma Plutonium. W. H. Zachariasen. *Los Alamos Scientific Laboratory (U. S. Atomic Energy Commission),* LA-1325, Sept. 1951. 11 p.

Gamma plutonium is found to be orthorhombic with eight atoms in a unit cell of dimensions (at 226° C.) $a_1 = 3.1518$ kX, $a_2 = 5.7568$ kX, $a_3 = 10.142$ kX. Tables, photographs. 3 ref. (M26, Pu)

275-M. X-Rays and Heat Treating. Roy W. Drier. *Metal Treating,* v. 7, May-June 1956, p. 12, 14.

X-ray diffractometry is an excellent analyzer of heat treatment factors. Diffractograms. (M22, J general)

276-M. (English.) **Dislocation Arrays and Rows of Etch-Pits.** B. A. Bilby and A. R. Entwisle. *Acta Metallurgica,* v. 4, no. 3, May 1956, p. 257-261.

Arrangement of pits in α-brass was found to be consistent with the assumption that each corresponds to an individual dislocation. Arrangement is correlated with that predicted for linear groups of dislocations piled up under shear stress. Graph, table, micrographs. 7 ref. (M26, Cu)

277-M. (English.) **Low-Frequency Studies of Dislocation Interactions With Solute Atoms.** S. Weinig and E. S. Machlin. *Acta Metallurgica,* v. 4, no. 3, May 1956, p. 262-267.

Internal friction of 99.999% copper and copper binary alloys investigated at 40° C. in a high-vacuum torsion pendulum at a 1 c.p.s. frequency of vibration. The effects of solute additions of 0.01 to 1 at.% aluminum, nickel and silicon were studied. Graphs, tables. 9 ref. (M26, Q22, Cu)

278-M. (English.) **A Study of (112) Edge Dislocations in Bent Silicon-Iron Single Crystals.** W. R. Hibbard Jr., and C. G. Dunn. *Acta Metallurgica,* v. 4, no. 3, May 1956, p. 306-315.

Cancellation of unlike dislocations was observed in detail during removal of a polygonization structure and also during removal of a cold worked structure. The change in distribution of edge dislocations after bending and annealing was investigated. Table, diagrams, graphs, micrographs. 19 ref. (M26, Fe)

279-M. (English.) **Dislocations at Compositional Fluctuations in Germanium-Silicon Alloys.** A. J. Goss, K. E. Benson and W. G. Pfann. *Acta Metallurgica,* v. 4, no. 2, May 1956, p. 332-333.

Spacing and alignment of etch-pits examined. Micrographs. 5 ref. (M26, Si, Ge)

280-M. (German.) **Screw Dislocation and Evaporation of Metal Single Crystals in Electron Microscope.** Michael Drechsler. *Zeitschrift für Metallkunde,* v. 47, no. 5, May 1956, p. 305-308.

Mechanism of evaporation, number, orientation and displacement of screw dislocations. Photograph, graph, table, diagram, micrographs. 11 ref. (M26)

281-M. (German.) **Decomposition of Crystal Surface During Evaporation and Its Relation to the Structure of Grain Boundaries.** Erwin Votava. *Zeitschrift für Metallkunde,* v. 47, no. 5, May 1956, p. 309-311.

In an investigation of sodium chloride crystals, characteristic edge structures were found along low-angle grain boundaries, for which only screw dislocations can be responsible. Diagrams, micrographs. 14 ref. (M26)

282-M. Direct Carbon Replicas From Metal Surfaces. E. Smith and J. Nutting. *British Journal of Applied Physics,* v. 7, June 1956, p. 214-217.

Methods for removal of carbon replica films directly evaporated on to etched metal surfaces involve either electropolishing or chemically etching after deposition of the carbon. (M21)

283-M. The Chromium-Rich Alloys of the Chromium-Titanium-Tungsten System at 900 and 1200° C. N. Ryan. *Commonwealth of Australia, Dept. of Supply, Aeronautical Research Laboratories Report No.* Met. 13, July 1955, 13 p. + 1 plate.

Metallographic and X-ray methods used to study 900 and 1200° C. isotherms of the chromium-titanium-tungsten system. Phase boundaries determined. (M24, W, Ti, Cr)

284-M. Ingot Structure. *Iron and Steel Institute, Journal,* v. 29, June 1956, p. 239-243.

Effect of casting temperature and pouring speed on structure and segregation in steel ingots. (M28, N12, D9, ST)

285-M. Moving Dislocations and Solute Atoms. Gunther Schoeck. *Physical Review,* v. 102, ser. 2, June 15, 1956, p. 1458-1459.

In the stress field of a moving dislocation, stress-induced local rearrangement of solute atoms takes place. From this rearrangement there results a friction force, which depends on the velocity of the dislocation. (M26, Q25)

286-M. The Lattice Spacings of Thin Electrodeposits of Cobalt and Nickel on a Copper Single Crystal. R. C. Newman. *Physical Society, Proceedings,* v. 69, no. 436B, Apr. 1956, p. 432-440.

Electron diffraction investigation shows that deposits have their normal lattice spacings. (M26, M22, L17, Co, Ni, Cu)

287-M. (German.) **Measurement of Temperature Rise in Specimens by Means of Electron Interference.** Albert Winkelmann. *Zeitschrift für Angewandte Physik,* v. 8, no. 5, May 1956, p. 218-221.

Measurement of temperature increase of gold-copper foil with 75 atomic % copper under electronic radiation is possible by comparing diffractograms. (M22, S16, Au, Cu)

288-M. (Russian.) **Distortions of the Crystal Lattice of Coarse and Fine-Grained Steel by Cold Plastic Deformation.** V. M. Finkel'. *Fizika Metallov i Metallovedenie,* v. 2, no. 1, 1956, p. 189-191.

Relation of intensity of lines to degree of deformation. Effect of texture. (M26, Q24)

289-M. (Slovak.) **Electrolytic Polishing of Metals for Metallographic Investigation.** Ivan Hrivnak. *Zvaranie,* v. 5, no. 2, Feb. 2, 1956, p. 46-48.

Techniques of electrolytic polishing in preparing specimens for microstructural studies, preparation of the electrolytes, equipment used. (M21, M27, L13, Ni, Cr, CN, ST, AY)

290-M. The Nature of the Film Formed on Copper During Electropolishing. E. C. Williams and Marjorie A. Barrett. *Electrochemical Society, Journal,* v. 103, July 1956, p. 363-366.

Film formed during electropolishing in orthophosphoric acid was found, by electron diffraction methods, to be composed of a phosphate of copper. Phenomenon seems to signify attainment of a solubility limit. (M26, L13, Cu)

291-M. (Czech.) **Advances in Metallographic Microscopy.** Ladislav Jenicek. *Hutnik,* v. 6, no. 1, Jan. 1956, p. 1-9 + 4 plates.

Review of progress in metallographic microscopy and macroscopy. Study of fractures, domain structure, phases, inclusions and impurities, and transformations. (M21, M23, S13, N8)

292-M. (French.) **Central Diffusion of X-Ray by Metals.** Jean Blin. *Publications scientifique et techniques du ministere de l'air,* 1956, no. 311, 97 p.

Study of the diffusion of rays by deformed metallic crystals and the variation of this diffusion as a function of the degree of cold-hardening of the metal. (M22, N1, N7)

293-M. (German.) **Amount and Types of Oxide Inclusions in Chromium-Manganese Case-Hardening Steels From the Time of Melting in Basic Openhearth Furnaces to Solidification.** Erwin Plöckinger. *Stahl und Eisen,* v. 76, no. 13, June 28, 1956, p. 810-824. (M27, D2, ST)

294-M. (Hungarian.) **Metallographic Examination of Large Dross Inclusions Occurring in Steels.** Zoltan Hegedüs *Kohaszati Lapok,* v. 9, no. 4, Apr. 1956, p. 165-172.

Origin of and causes for large inclusions; examination by microscope and etching; determination of the origin of the inclusion from its structure. (M general, ST)

295-M. (Japanese.) **Method for Revealing the Austenite Grain Size in Steel.** Chiaki Asada and Ryo Kadowaki. *Iron & Steel Institute of Japan, Journal,* v. 42, no. 6, June 1956, p. 476-481.

New method for identifying grain boundaries utilizes special polishing and proper etching techniques for specimens hardened and tempered to the brittle sorbitic structure. (M21, N8, ST)

296-M. (Russian.) **A Rapid Method for Examining the Primary Structure of Welded Joints.** A. A. Rossochinskii. *Zavodskaia Laboratoriia,* v. 22, no. 5, May 1956, p. 558-560.

Method for treatment of polished microsections of specimens in two different solutions, securing a better exposure of the structure of primary crystallization. (M21, K1, M27)

N.

Transformations and Resulting Structures

281-N. Beta Transus Determination of 3-Mn Complex Titanium Alloy Extrusion. H. C. Turner. *Convair, Report No.* 8711, Feb. 1955, 6 p.

The upper beta transus temperature was between 1400 and 1450° F. Micrographs, diagram, table. (N11, Ti)

282-N. The Solid Solubilities of Tin, Indium, and Cadmium in Aluminium. L. E. Samuels. *Institute of Metals, Journal,* v. 84, May 1956, p. 333-336 + 2 plates.

The use of mechanical polishing to reveal the finest optically resolvable precipitates in a metallographic examination is found superior to electrolytically polished specimens. Photographs, graphs. 14 ref. (N12, M21, Sn, In, Cd, Al)

283-N. Transformations in Disordered Gold-Copper Alloys. G. C. Kuczynski, M. Doyama and M. E. Fine. *Journal of Applied Physics,* v. 27, June 1956, p. 651-655.

By measurement of the specific heat, temperature coefficient of expansion, Young's modulus and yield point, it was established that the Cu_3Au alloy undergoes a phase transition between 550 and 600° C. and possibly another one near 850° C. Table, graphs. 18 ref. (N10, Au, Cu)

284-N. Precipitation Phenomena in Supersaturated Solid Solutions. A. Guinier. *Journal of Metals,* v. 8, May 1956, p. 673-682.

Sequence theory of precipitation, physical and X-ray evidence for the precipitation stage, nature of the zones. Diagrams, graphs, photographs, micrograph, diffractograms. 48 ref. (N7)

285-N. Diffusion of Nitrogen in Iron. Paul E. Busby, Donald P. Hart and Cyril Wells. *Journal of Metals,* v. 8, May 1956, p. 686-687.

Diffusion in α-iron studied by fractional saturation method. Resulting diffusion coefficients are in excellent agreement with the values obtained from internal friction experiments. Graph, table. 13 ref. (N1, Fe)

286-N. Self-Diffusion in Solid Nickel. R. E. Hoffmann, F. W. Pikus and R. A. Ward. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 483-486.

Self-diffusion coefficient was measured over the range from 870 to 1248° C. Measured activation energy correlates satisfactorily with absolute melting point, heat of fusion and heat of sublimation. Tables, graphs. 16 ref. (N1, P12, Ni)

287-N. Evaluation of the Structural Stability of Ti-Mo-V Alloys. W. F. Carew, F. A. Crossley and H. D. Kessler. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 491-496.

Metastable β alloys in the titanium-rich corner of the system were studied in the temperature range from 300 to 550° C. Metallographic examination coupled with hardness measurements were employed to follow structural changes. Graphs, micrographs, diagrams. 13 ref. (N6, V, Mo, Ti)

288-N. Measurement of Grain Growth Rates in Recrystallization. C. D. Graham, Jr., and R. W. Cahn. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 504-508.

The rate of growth of a single grain growing into a strained aluminum single crystal, measured by the conventional heat-cool-etch technique, is shown to decrease with time at temperature. X-ray measurements found it to be linear. Diagrams, graphs, photograph. 20 ref. (N5, N3, Al)

289-N. Precipitation Hardening in a Ti-Cu Alloy. L. M. Howe, E. Saarema and J. Gordon Parr. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 512-513.

Powder specimens were readily susceptible to age-hardening treatments. Graphs. 4 ref. (N7, Ti, Cu)

290-N. Grain Boundary Mobilities in High Purity Silver. W. E. Bron and E. S. Machlin. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions;* v. 206, May 1956, p. 513-514.

Grain boundary migration in V-shaped thin specimens studied. Micrograph. 5 ref. (N3, Ag)

291-N. Grain Growth Rates and Orientation Relationships in the Recrystallization of Aluminum Single Crystals. C. D. Graham, Jr., and R. W. Cahn. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 517-521.

Growth rates are found to be insensitive to orientation, except that new grains with orientations similar to the matrix or to a twin of the matrix have very low mobilities. Diagrams. 40 ref. (N3, N5, Al)

292-N. Phase Transformations in Titanium-Rich Alloys of Nickel and Titanium. D. H. Polonis and J. Gordon Parr. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 531-536.

The decomposition of a completely retained β phase and of a completely transformed β phase in a 6% alloy was followed by X-ray diffraction and metallographic methods and by hardness determinations made during the process. Graphs, phase diagram, micrographs. 14 ref. (N6, Ni, Ti)

293-N. Influence of Boron on the Rate of Transformation of High Purity Iron. M. E. Nicholson. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 551-553.

The effect of boron on the austenitic transformation rate of iron is smaller than on low-carbon steels. The influence of austenitizing temperature on boron-iron alloys is the reverse of its influence on steels. Graph. 11 ref. (N8, B, Fe)

294-N. Pressure-Temperature-Composition Relations in the Cr-N Terminal Solid Solution. A. U. Seybolt and R. A. Oriani. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 556-562.

The partial molal heat of solution, the activity of nitrogen in solid solution and the partial molal free energy were computed. Micrographs, graphs, tables, diagrams. 12 ref. (N12, Cr)

295-N. Solute Diffusion in Nickel-Base Substitutional Solid Solutions. R. A. Swalin and Allan Martin. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 567-572.

Diffusion rates of manganese, aluminum, titanium and tungsten in nickel measured at temperatures between 1100 and 1300° C. Tables, graphs. 16 ref. (N1, W, Ti, Al, Mn, Ni)

296-N. Evidence for Solidification of a Metastable Phase in Fe-Ni Alloys. R. E. Cech. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 585-589.

Body-centered-cubic-phase nucleates from the liquid in small particles of a 29.5% nickel-70.5% iron alloy. Diagram, micrographs, graphs. 4 ref. (N12, Fe, Ni)

297-N. Sigma Nucleation Times in Stainless Steels. G. F. Tisinai, J. K. Stanley and C. H. Samans. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 600-604.

The times at which the first detectable amount of σ phase forms at temperatures between 900 and 1800° F. were determined. Both X-ray diffraction and metallography were used to detect σ in highly strained filings; metallography alone to detect it in annealed bulk samples of stainless steels. Tables, graphs. 12 ref. (N2, SS)

298-N. Heat Evolved and Volume Change in the Alpha-Sigma Transformation in Cr-Fe Alloys. Howard Martens and Pol Duwez. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 614.

Standard thermal analysis experiments were performed on heating specimens of σ at the rate of approximately 40° C. per sec. A definite thermal arrest was observed at 870° C. indicating that the reverse reaction of α into σ is exothermic. Graphs. 4 ref.
(N6, P11, P12, Cr, Fe)

299-N. (English.) **The Growth of Dispersed Precipitates in Solutions.** G. W. Greenwood. *Acta Metallurgica,* v. 4, no. 3, May 1956, p. 243-248.

Approximate formulas derived are capable of predicting growth rates of the correct order of magnitude. Tables, diagram, graphs. 13 ref.
(N7, N12)

300-N. (English.) **Closed Miscibility Gaps in Ternary and Quaternary Regular Alloy Solutions.** J. L. Meijering and H. K. Hardy. *Acta Metallurgica,* v. 4, no. 3, May 1956, p. 249-256.

Spinodal equation of quaternary regular solutions derived and the co-ordinates of second-order critical points given as a function of the six binary interaction parameters. Diagrams, table. 17 ref. (N12, M24)

301-N. (English.) **Mechanism of Whisker Growth. III. Nature of Growth Sits.** S. S. Brenner and G. W. Sears. *Acta Metallurgica,* v. 4, no. 3, May 1956, p. 268-270.

A mechanism for formation of whiskers on a crystal which is growing by vapor deposition. A necessary condition is the existence of diffusion-limited transfer of material or heat. Diagrams, 8 ref.
(N12, N15, M26)

302-N. (German.) **Mechanics and Kinetics of Martensite Formation Without Diffusion.** H. Knapp and U. Dehlinger. *Acta Metallurgica,* v. 4, no. 3, May 1956, p. 289-297.

Empirical results with martensite exclude nucleation owing to fluctuations, though the curve of distortion energy per mole including the interfacial energy, tends to infinity with decreasing nuclear size. Diagrams, graphs. 27 ref. (N8, N9)

303-N. (English.) **A Crystallographic Study of Mercuric Iodide.** J. B. Newkirk. *Acta Metallurgica,* v. 4, no. 3, May 1956, p. 316-330.

Crystals grow from the liquid or vapor state by the spread of successive parallel layers over the crystal surface. They also sublime and melt by the recession of layers. Graphs, diagrams, micrographs, diffractograms. 14 ref. (N12, N15, M26)

304-N. (French.) **Various Remarks on the Formation of Uranium Monoxide.** J. Williams and K. H. Westmacott. *Revue de Métallurgie,* v. 53, no. 3, Mar. 1956, p. 189-204 disc., p. 204.

Suggests that uranium mononitride and monocarbide operate as catalyzers in the formation of monoxide; growth of the monoxide film can be explained by the diffusion of the uranium ion in both oxides. Diagram, micrographs. 17 ref.
(N16, N1, L14 U)

305-N. (German.) **Structure and Magnetic Properties of Permanent Magnet Alloys During Isothermal Age-Hardening. I. Growth of Particles, Critical Particle Size and Coercivity.** Eginhart Biedermann and Eckart Kneller. *Zeitschrift für Metallkunde,* v. 47, no. 5, May 1956, p. 289-301.

Process of particle growth in several copper-nickel-iron alloys determined as a function of annealing time by means of examination by X-ray and electron microscope. Tables, micrographs, diagrams, graphs, diffractograms. 34 ref.
(N7, P16, J27, Cu, Ni, Fe, SG-n)

306-N. Rates of Surface Self-Diffusion Over the Principal Planes of a Single Crystal of Copper. Norman Hackerman and Norman H. Simpson. *Faraday Society, Transactions,* v. 52, May 1956, p. 628-633.

Diffusion coefficients were found to be of the order of 10^{-5} but differed measurably on the three planes as well as along different axes of the (100) plane. (N1, Cu)

307-N. Solidification of Steel. B. Gray. *Iron and Steel Institute, Journal,* v. 29, June 1956, p. 235-239.

Effects of gravity on crystal growth. (N12, CI)

308-N. Theory of the Sputtering Process. Don E. Harrison, Jr., *Physical Review,* v. 102, ser. 2, June 15, 1956, p. 1473-1480.

Mathematical methods of neutron diffusion theory applied to the problem of cathode sputtering.
(N15, L25)

309-N. The Metallographic View. Metallography of Carburized Cases. XXIII. H. E. Bover. *Steel Processing,* v. 42, June 1956, p. 331-332.

Effect of retained austenite, susceptibility of alloy steels, prevention methods. (N8, J28, ST)

310-N. (German.) **Calculation of Diffusion Processes at Changeable Temperatures.** Bernhard Ilschner. *Archiv für das Eisenhüttenwesen,* v. 27, no. 5, May 1956, p. 337-342.

Derivation of diffusion equations for changeable temperature. Effect of preheating time in isothermal investigations. (N1)

311-N. (German.) **The Influence of Certain Elements on the Formation of Nodular Graphite in Cast Iron.** Johann Verelst and Albert De Sy. *Giesserei,* v. 34, no. 12, June 1956, p. 305-315.

Influence of aluminum, copper, lead and bismuth in the presence of traces of titanium. Theoretical considerations regarding growth of graphite nodules in gray cast iron, mechanism of diffusion and distribution of interfering elements, and the interference mechanism itself.
(N8, E25, CI)

312-N. (German.) **On the Mechanism of Crystallization of Graphite in Hypereutectoid Iron.** E. Feil. *Giesserei,* v. 43, no. 12, June 1956, p. 315-318.

Chemical examination of principal components of graphite. Metallographic investigation of graphite and phosphide formation. Types of graphite formation. Tables, micrographs. 5 ref. (N8, M general, CI)

313-N. (German.) **Relations Between Temperature and Time in the Process of Hardening a Molybdenum-Vanadium-Tungsten High-Speed Steel.** Karl Bungardt and Rudolf Oppenheim. *Stahl und Eisen,* v. 76, no. 11, May 31, 1956, p. 689-699; disc., p. 699-700.

Effect of quenching, temperature and time on the carbide solution, grain growth, content of residual austenite, hardness, resistance to temper brittleness, impact bending toughness and cutting power in rough and finish machining. Relations between carbide solution, grain growth and impact bending toughness.
(N8, N3, Q general, J26, G17, AY)

314-N. (Russian.) **Study of the Structure of Steels 30 KhMA and Kh(ShKh-15) After the Bainitic Transformation.** L. S. Palatnik and B. A. Leont'ev. *Fizika Metallov i Metallovedenie,* v. 2, no. 1, 1956, p. 43-53.

Bainitic transformation, which has traits in common with the perlitic and martensitic transformations, consists of three processes: oriented precipitation of supersaturated ferrite; enriching surrounding austenite with carbon and formation of carbides; and tempering of supersaturated ferrite. (N8, AY)

315-N. (Russian.) **Effect of Internal Stresses Due to Phase Transformation Brought About by Low-Temperature Treatment on the Martensite Start (M_s) Temperatures of High-Speed Steel.** P. M. Iushkevich. *Fizika Metallov i Metallovedenie,* v. 2, no. 1, 1956, p. 54-56.

Cyclic tempering treatments, with soaking at 560 and 580° C. and cooling down to 0 and −40° C., to eliminate retained austenite and stress. Hardening, tempering temperatures, soaking times and other factors in relation to M_s temperatures.
(N8, J29, J26, J1, TS-m)

316-N. (Russian.) **Problem of the Rate of Diffusion of Phosphorus in Steel.** V. N. Svechnikov and S. S. Golubev. *Fizika Metallov i Metallovedenie,* v. 2, no. 1, 1956, p. 88-92 + 2 plates.

Effect of various heat treatments and the temperature and time factors involved, including soaking time and rate of cooling. Phosphorus and carbon redistribution in relation to alpha and gamma phase temperature range. (N1, J general, CN)

317-N. (Russian.) **The Influence of the Alpha-Phase on the Quality of Stainless Sheets.** R. P. Radchenko. *Stal',* v. 16, no. 5, May 1956, p. 450-452.

To avoid formation of considerable amounts of alpha-phase in ingots, which accounts for surface flaws on slabs and sheets, ingots should not be heated above 1250° C. and without overheating individual faces and edges. (N8, F23, SS)

318-N. (Ukrainian.) **On Distribution of Certain Additives in Welded Joints.** Rossoshyns'kyi. *Dopovidi Akademii Nauk, Ukrains'koi RSR,* 1956, no. 2, p. 137-139.

Experimental data on distribution of carbon, phosphorus, nickel, manganese and chromium in the cross section of butt-welded steel joints. The grain boundaries are enriched in carbon, chromium and phosphorus, but not in nickel and manganese. (N12, N1, K1, ST)

319-N. Allotropic Modification of Calcium. J. F. Smith, O. N. Carlson and R. W. Vest. *Electrochemical Society, Journal,* v. 103, July 1956, p. 409-413.

X-ray diffraction patterns show that 99.9% calcuim exists in only two allotropic forms: face centered cubic to 464°C. and body-centered cubic from 464°C. to the melting point. (N6, Ca)

320-N. Equilibrium Diagrams and Single Crystal Growth. Samuel Zerfoss. *Science,* v. 124, July 6, 1956, p. 9-13.

Compositions on a typical binary phase equilibrium diagram are related to growth from the melt by the crucible, the withdrawal and the flame fusion methods. (N12, M24)

321-N. Dilatometric Studies of Zirconium and Zirconium-Tin Alloys Between 25 and 1100° C. R. W. Balluffi, R. Resnick and A. J. Timper. *Sylvania Electric Products, Inc. (U. S. Atomic Energy Commission),* SEP-90, June 1952, 13 p.

A volume decrease occurred in all alloys as a result of the alpha-to-beta transformation in contrast to the expansion predicted by available X-ray data. (N6, M23, Zr, Sn)

322-N. (English.) Observation of Bainite Transformation by Hot-Stage Microscope. Kazuo Tsuya. *Journal of Mechanical Laboratory (Japan),* v. 1, 1955, p. 1-9.

Points where bainite transformation differs from pearlite and martensite transformation were observed. (N8, ST)

323-N. (English.) **Age-Hardening of Titanium-Iron Alloys.** Susumu Yoshida, Hidehiko Yoshida, Takashi Araki and Yuko Tsuya. *Journal of Mechanical Laboratory (Japan),* v. 1, 1955 p. 10-13.

Hardness increases occurring in low-temperature aging are largely attributed to precipitation of the omega intermediate phase. (N7, Ti, Fe)

324-N. (English.) **The Surface Relief Effect Due to Bainite Transformation Observed by Hot Stage Microscope.** Kazuo Tsuya and Tetsutaro Mitsuhashi. *Journal of Mechanical Laboratory (Japan),* v. 1, 1955, p. 42-48.

Relief markings due to bainite formation grow slowly and the rate of growth increases as the transformation temperature increases. (N8)

325-N. (French.) **New X-Ray Observations of Pre-Precipitation Phenomena Is Al-Zn-Mg Alloy With 7% Zn and 3% Mg.** René Graf. *Comptes rendus,* v. 242, no. 24, June 11, 1956, p. 2834-2836.

Phenomena are due to sphere-shaped zones coherent with the matrix. This "cold hardening" takes place up to 100° C. whereas "hot hardening", characterized by precipitation of $MgZn_2$, bigins at 50° C. (N7, Al, Zn, Mg)

326–N. (French.) **Research on the Kinetics of Martensitic Transformation.** J. Philibert. *Institut de Recherches de la Sidérurgie, Publications,* ser. A, no. 139, May. 1956, 98 p. + 10 plates.

Study is conducted on two hypereutectoid steels and a ferro-nickel. The problem of "germination" of the martensite and the problem of stabilization of residual martensite are investigated. (N8, AY, Fe)

327-N. (French.) **Study of the Appearance and Stability of the Polygonized State in Pure Iron and Aluminum Crystals.** Ch. de Beaulieu. *Institut de Recherches de la Sidérurgie, Publications,* ser. A, no. 132, Apr. 1956, 42 p.

New properties of very pure iron and aluminum; polygonization as a function of purity. (N5, Q general, Fe, Al)

328-N. (French.) **The Effect of Gravity in the Solidification of Steel.** B. Gray. *Revue de Métallurgie,* v. 53, no. 5, May 1956, p. 379-387.

Macrostructures obtained in vertically cast, bottom-poured steel ingots with different feeding arrangements. The presence of convection currents had a powerful effect on the resulting structures. The hypotheses advanced are applied to the problem of heterogeneity in horizontal castings and to cases for which there has been no generally accepted mechanism. (N12, D9, M28, ST)

329-N. (Japanese.) **Some Aspects of Grain Growth Characteristics of Austenite in Coarse-Grained Steels.** Yoshiaki Masuko. *Iron & Steel Institute of Japan, Journal,* v. 42, no. 6, June 1956, p. 482-489.

Conclusions presented regarding grain size control in steels for high-pressure and high-temperature piping service. (N3, ST)

330-N. (Japanese.) **Study on the High Speed Tools. XVII.** Hideji Hotta and Itsuro Tatsukawa. *Iron & Steel Institute of Japan, Journal,* v. 42, no. 6, June 1956, p. 495-498.

Influence of austenitizing temperatures, between 1260 and 1350° C. on behavior in austempering at the intermediate region 200 to 400° C. and subsequent tempering, was studied by micrography and hardness tests on a high speed steel. (N8, J26, TS-m)

331-N. (Russian.) **Growth in Gray Cast Iron.** F. N. Tavadze and I. A. Bairamashvili. *Liteinoe Proizvodstvo,* 1956, no. 5, May 1956, p. 15-18.

Experimental data on the qualitative and quantitative influence of graphitization and oxidation on the growth in gray cast iron. (N3, CI)

332-N. (Russian.) **The Influence of Alloying Components on the Kinetics of Graphitization in White Cast Iron.** M. A. Krishtal. *Liteinoe Proizvodstvo,* 1956, no. 5, May 1956, p. 18-20.

A study of the influence of alloying elements on the graphitization rate and the mobility of matrix atoms in the austenite of cast iron. (N8, CI)

333-N. (Russian.) **Oxygen Content in Oxygen-Treated Cast Iron.** N. A. Voronova. *Liteinoe Proizvodstvo,* 1956, no. 5, May 1956, p. 23-26.

Thermodynamic calculation and experimental determination of solubility of oxygen in cast iron. (N12, CI)

334-N. (Russian.) **Structural Transformations in Cast Iron During Welding.** P. S. Elistratov. *Metallovedenie i Obrabotka Metallov,* 1956, no. 4, Apr. 1956, p. 10-14.

Effect of welding temperatures and heating and cooling rates on structure of the weld zone. (N8, N5, K1, CI)

335-N. (Russian.) **Role of Intercrystalline Components in the Formation of Hot Cracks in Welded Seams.** V. A. Toropov. *Metallovedenie i Obrabotka Metallov,* 1956, no. 4, Apr. 1956, p. 45-50 + 2 plates.

Effect of carbon, silicon, sulphur and phosphorus on formation of hot cracks and on mechanical properties of welded seam. Role of carbide eutectic in relation to hardness and strength. (N8, Q23, Q29, K1, AY)

336-N. (Russian.) **Magnetic Control of the Hardening and Annealing Qualities of Ball and Roller Bearing Parts.** M. N. Mikheev, G. S. Tomilov, M. F. Pomukhin, K. G. Rziankin and V. A. Utkina. *Zavodskaia Laboratoriia,* v. 22, no. 5, May 1956, p. 549-555.

Device for differential measurement of magnetic properties of steel parts tested for permissible residual austenite content and for proper heat treatment. (N8, Q23, P16, ST)

337-N. (Spanish.) **Variation of the Transformation Temperatures of S. A. E. 52100 Steel.** Enrique D. Bia. *Instituto de Ensayo de Materiales,* Montevideo, Publication No. 29, Boletin de la Facultad de Ingenieria, v. 5, no. 12, Mar. 1956, 12 p.

Determination of the effect of varying the heating and cooling cycles on the transformation temperatures. (N8, AY)

338-N. Solid Solubility of Lithium in Aluminum. S. K. Nowak. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 553-556.

The lithium solubility limit in solid aluminum determined by micrographic techniques. Micrographs, graphs, tables. 8 ref. (N12, Li, Al)

P
Physical Properties and Test Methods

319-P. Some Aspects of Liquid Metals. L. H. J. Harper. *Birmingham Metallurgical Society, Journal,* v. 36, Mar. 1956, p. 346-359.

Structure, properties, viscosity-composition relationships, fludity, liquid metal pumps. Table, graphs, diagram. 16 ref. (P general, M26)

320-P. Paramagnetism of the γ Phase in Copper-Manganese Alloys. H. P. Myers. *Canadian Journal of Physics,* v. 34, June 1956, p. 527-534.

Measurements of paramagnetic susceptibility and its variation with temperature in alloys having compositions from 10 to 90 at. % manganese. Graphs. 6 ref. (P16, Mn, Cu)

321-P. Anodic Transients of Copper in Hydrochloric Acid. Ralph S. Cooper. *Electrochemical Society, Journal,* v. 103, June 1956, p. 307-315.

Transients were studied using horizontal anodes shielded to prevent convection. Results were in quantitative agreement with Müller's theory except for a second plateau due to the initiation of a new reaction involving the OH ion. Tables, diagrams, graphs. 13 ref. (P15, Cu)

322-P. Electrokinetic Potentials on Bulk Metals by Streaming Current Measurements. II. Gold, Platinum, and Silver in Dilute Aqueous Electrolytes. Ray M. Hurd and Norman Hackerman. *Electrochemical Society, Journal,* v. 103, June 1956, p. 316-319.

Potentials measured in distilled water, potassium chloride and potassium hydroxide. Graph, tables, diagrams. 6 ref. (P15, Au, Pt, Ag)

323-P. Galvanic Potentials of Grains and Grain Boundaries in Copper Alloys. R. Bakish and W. D. Robertson. *Electrochemical Society, Journal,* v. 103, June 1956, p. 320-325.

The measured potentials could be correlated directly with observed structural changes and susceptibility to stress corrosion cracking. Diagram, table, graphs. 9 ref. (P15, R1, M27, Cu)

324-P. Effect of Strain on the Work Function of Polycrystalline Silver. George Wallis and H. E. Farnsworth. *Journal of Applied Physics,* v. 27, June 1956, p. 594-598.

Contact potential difference measurements indicate that mechanically induced strain of the order of 1% in polycrystalline strips of silver produces an increase in work function of between 0.01 and 0.03 e.v. Table, graphs, diagram. 8 ref.
(P15, Ag)

325-P. Some Resistivity Effects of Short-Range Order in α Brass. A. C. Damask. *Journal of Applied Physics,* v. 27, June 1956, p. 610-616.

The annealing kinetics of resistance changes produced in 30% zinc α brass by quench, neutron irradiation at 50° C. and cold work. Graphs. 34 ref. (P15, N10, Cu, Zn)

326-P. Sulfur Pressure Measurements Above FeS in Equilibrium With Iron. C. L. McCabe, C. B. Alcock and R. G. Hudson. *Journal of Metals,* v. 8, May 1956, p. 693-694.

Measurements by the Knudson orifice method gave good agreement with previous determinations. Graphs, tables. 11 ref. (P13, Fe)

327-P. Melting Point Determination of Hafnium, Zirconium, and Titanium. D. K. Deardorff and Earl T. Hayes. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 509-511.

Technique of determination is improved by gradient heating and refinements in cavity preparation to obtain true black-body conditions. Diagram, tables. 4 ref.
(P12, Hf, Zr, Ti)

328-P. On the Relationship Between Resistivity and Lifetime in Semiconductors. Wolfgang Gärtner. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 612-613.

Traps are much more effective in low resistivity material, thus reducing the carrier lifetime. Graphs. 9 ref. (P15)

329-P. Weak Field Magnetoresistance of *n*-Type Germanium. Colman Goldberg and R. E. Davis. *Physical Review,* v. 102, ser. 2, June 1, 1956, p. 1254-1257.

Measurements are in agreement with the model that assumes that the energy surfaces are ellipsoids oriented along the (111) directions in k-space. Graphs, table. 10 ref.
(P15, P16, M26, Ge)

330-P. Heat Capacity of Titanium Between 4° K and 15° K. M. H. Aven, R. S. Craig, T. R. Waite and W. E. Wallace. *Physical Review,* v. 102, ser. 2, June 1, 1956, p. 1263-1264.

Measurement procedure and results. Graph, table. 3 ref. (P12, Ti)

331-P. Temperature Dependence of the Hall Coefficients in Some Copper-Nickel Alloys. F. E. Allison and Emerson M. Pugh. *Physical Review,* v. 102, ser. 2, June 1, 1956, p. 1281-1287.

The two Hall coefficients and the resistivity of alloys containing 60%, 70% and 80 % nickel measured from 4 to 400° K. Graphs, tables, diagram. 20 ref. (P15, Ni, Cu)

332-P. Domain Structure as Affected by the Uniaxial Ferromagnetic Anisotropy Induced in Cubic Solid Solutions. Mikio Yamamoto, Satoshi Taniguchi and Keizo Aoyagi. *Physical Review,* v. 102, ser. 2, June 1, 1956, p. 1295-1297.

Perminvar-type magnetic properties are due to the stabilization of domain walls by the induced uniaxial anisotropy in face-centered cubic solid solutions and in body-centered cubic solid solutions with negative cubic anisotropy constants. Diagram, micrographs. 8 ref.
(P16, SG-n)

333-P. (English.) **On Thermodynamical Analysis by Calorimetry Alone.** J. L. Meijering. *Acta Metallurgica,* v. 4, no. 3, May 1956, p. 333-335.

Principles, advantages and applications. Diagrams. 3 ref. (P12)

334-P. (Russian.) **Resistance of Steel to Alternating Current.** B. B. Timofeev. *Elektrichestvo,* 1956, no. 5, May 1956, p. 50-54.

Simplified method of calculating resistance to sinusoidal alternating current of a massive low-carbon steel conductor with low and medium intensities of magnetic field on its surface. Graphs. 4 ref.
(P15, P16, CN)

335-P. (Russian.) **Electroconductivity of Certain Compounds of Transition Metals With Boron, Carbon, and Nitrogen, and of Their Alloys.** G. V. Samsonov. *Zhurnal Tekhnicheskoi Fiziki,* v. 26, no. 4, Apr. 1956, p. 716-722.

The resistivity of a number of borides, carbides, and nitrides of transition metals, and also of their mutual and mixed alloys. Relation between resistivity and the deficient electron levels. Tables, graphs. 29 ref. (P15)

336-P. Mass Transfer in Liquid Metals. W. E. Dunn, C. F. Bonilla, C. Ferstenberg and B. Gross. *A.I.Ch. E. Journal,* v. 2, June 1956, p. 184-189.

Experiments on the dissolving of horizontal metal cylinders by mercury in natural convection and of zinc tubes and beds of lead shot by mercury in forced convection agreed with the best available dimensionless correlations for mass transfer in nonmetals under the same conditions.
(P10, R6, Hg, Zn, Cd, Pb, Sn)

337-P. Thermal Electromotive Force of Uranium, Titanium, and Zirconium. L. L. Wyman and J. F. Bradley. *Knolls Atomic Power Laboratory (U. S. Atomic Energy Commission),* KAPL-852, Dec. 1952, 20 p.

Thermal electromotive force of thermocouples as function of temperature; effect of variables such as cold working, annealing and thermal cycling upon electromotive force of uranium-platinum thermocouple. (P15, S16, U, Ti, Zr)

338-P. Spectral Emissivity of Rhenium. D. T. F. Marple. *Optical Society of America, Journal,* v. 46, July 1956, p. 490-494.

Method of measurement and equipment; comparison with previous experiments and the theory. (P17, Re)

339-P. Hall Coefficient and Thermoelectric Power of Thorium Metal. Joseph H. Bodine, Jr., *Physical Review,* v. 102, ser. 2, June 15, 1956, p. 1459.

The Hall coefficient of two samples of thorium metal was measured at room temperature in magnetic fields on the order of 4000 gauss, and an average value of -1.2×10^{-11} v.—cm. per abampere gauss obtained. (P15, Th)

340-P. Hall Effect in Gray Tin Filaments. E. E. Kohnke and A. W. Ewald. *Physical Review,* v. 102, ser. 2, June 15, 1956, p. 1481-1486.

In contradiction to the results for *n*-type samples, *p*-type samples indicate mobility ratios slightly higher than unity. The field dependence of the Hall coefficient of *p*-type specimens shows a shift of the cross-over to higher temperatures with increasing magnetic field.
(P15, P16, Sn)

341-P. Components of the Thermodynamic Functions of Iron. R. J. Weiss and K. J. Tauer. *Physical Review,* v. 102, ser. 2, June 15, 1956, p. 1490-1495.

The functions enthalpy, entropy and free energy of alpha and gamma iron are determined from existing data and resolved into their magnetic, lattice and electronic components on the basis of additivity of the respective specific heat components. (P12, Fe)

342-P. Investigation of the Superconductivity of Hafnium. Robert A. Hein. *Physical Review,* v. 102, ser. 2, June 15, 1956, p. 1511-1518.

Indicates that pure hafnium is probably not a superconductor down to a temperature of 0.08° K.
(P15, Hf)

343-P. The Electrical Conductivity of Anisotropic Thin Films. R. Englman and E. H. Sondheimer. *Physical Society Proceedings,* v. 69, no. 436B, Apr. 1956, p. 449-458.

When the electron free path is large, the theoretical electrical conductivity of single crystal metal films exhibit anomalous anisotropic properties similar to, but even more pronounced than, those found in the anomalous skin effect in anisotropic metals. (P15)

344-P. Heat Capacity of Silver Below 4.2°K. J. A. Rayne. *Physical Society, Proceedings,* v. 69, no. 436B, Apr. 1956, p. 482-483.

Experimental measurements.
(P12, Ag)

345-P. Electron and Nuclear Spin Resonance and Magnetic Susceptibility Experiments on Dilute Alloys of Mn in Cu. J. Owen, M. Browne, W. D. Knight and C. Kittel. *Physical Review,* v. 102, ser. 2, June 15, 1956, p. 1501-1507.

Simple model leads to the prediction of indirect exchange ferromagnetism; electronic Knight shift of the electron spin resonance line; nuclear Knight shift of the copper nuclear resonance; electron spin relaxation by the coupling with the conduction electrons; and a contribution to the electrical resistivity by the Elliott-Schmitt mechanism.
(P16, Mn, Cu)

346-P. (German.) **Potential-Forming Phenomena on Austenite Chromium-Nickel Steels in Distilled Water and in Neutral Halogen Salt Solutions.** Carl Carius. *Archiv für das Eisenhüttenwesen,* v. 27, no. 5, May 1956, p. 323-335.

Effect of various etching agents on potential. Steel-oxygen electrode and its reversibility. (P15, AY)

347-P. (German.) **Powder Specimen and Magnetizing Processes in Highly Coercive Alnico Magnets.** A. Kussmann and J. H. Wollenberger. *Zeitschrift für Angewandte Physik,* v. 8, no. 5, May 1956, p. 213-216.

Detection of magnetic zone-structures of Alnico permanent magnets of high coercivity by Bitter method.
(P16, SG-n)

348-P. (Russian.) **Investigation of the Influence of Diffused Hydrogen on the Potential of Iron in Alkaline Solutions.** I. A. Bagotskaia. *Doklady Akademii Nauk SSSR,* v. 107, no. 6, June 1956, p. 843-846.

An experimental study of the influence of diffusing atomic hydrogen on the potential of iron in an electrolytic solution of sodium hydroxide. (P15, Fe)

349-P. (Russian.) **Thermodynamic Description of the Magnetization of Ferromagnetic Substances Near the Curie Temperature.** K. P. Belov and A. N. Goriaga. *Fizika Metallov i Metallovedenie,* v. 2, no. 1, 1956, p. 3-9.

Measurements of true magnetization of nickel and several nickel alloys in the vicinity of the Curie point. Method of determining relation between temperature and spontaneous magnetization. (P16, Ni)

350-P. (Russian.) **Interrelation of the Anisotropy of the Hall Effect and the Variation of Resistance in a Magnetic Field. I. Study of Tin and Indium.** E. S. Borovik. *Fizika Metallov i Metallovedenie,* v. 2, no. 1, 1956, p. 33-42.

Interrelation is studied at 4°C. for indium and at 4 and 20 °C. for tin, in fields up to 5000 oersteds. Anisotropy of mobility of electrons and holes is calculated for a model with two groups of holes and electrons. (P15, P16, Sn, In)

351-P. (Russian.) **Influence of Manganese, Chromium, and Vanadium on the Surface Tension of Liquid Iron (Steel).** T. P. Kolesnikova and A. M. Samarin. *Izvestiia akademii Nauk SSSR, Otdelenie Tekhnichesikikh Nauk,* no. 5, May 1956, p. 63-69.

Determination of surface tension by the method of gas bubbles, with consideration of oxygen content and nonmetallic inclusions. (P10, ST, Fe)

352-P. (Russian.) **Dependence of Overvoltage on the Electrode Material.** R. M. Vasenin. *Zhurnal Fizicheskoi Khimii,* v. 30, no. 3, Mar. 1956, p. 629-638.

If different materials are used as electron transmitters for the hydrogen electrode the potential difference of metal solution in contrast to the usually measured potential of the hydrogen electrode will depend upon the nature of the metal. (P15)

353-P. **Measurement of Specific Heats by a Pulse Method.** Richard C. Strittmater and Gordon C. Danielson. *Ames Laboratory (U. S. Atomic Energy Commission),* ISC-666, Aug. 1955, 27 p.

The apparatus delivers a current of sufficient magnitude to heat a fine wire sample to a melting temperature in a short time. By simultaneous recording with a dual-beam cathode ray oscilloscope, the current through and the potential across a sample, one can determine at any instant the power input and the resistance of the wire. (P12)

354-P. **Intermetallic Semiconductors.** H. J. Hrostowski. *Bell Laboratories Record,* v. 34, July 1956, p. 246-250.

It may be possible to produce more versatile transistors and other semiconductor devices using intermetallic compounds with a wider range of electrical properties than is obtainable with silicon and germanium. (P15)

355-P. **Reaction of Hydrogen With Uranium.** W. M. Albrecht and M. W. Mallett. *Electrochemical Society, Journal,* v. 103, July 1956, p. 404-409.

The reaction was found to follow a linear rate law after initial deviations. The data indicate at least two different rate-controlling processes in the temperature and pressure ranges investigated. (P13, U)

356-P. **Irradiation of Germanium by Fast Monoenergetic Neutrons.** J. W. Moyer, W. A. Smith, Jr., and O. L. Cunningham. *Knolls Atomic Power Laboratory (U. S. Atomic Energy Commission)* KAPL-1455, May 1956, 33 p.

The effect upon the electrical resistivity and the Hall coefficient was studied. Changes in carrier concentrations were observed in the case of gold-doped materials. (P15, Ge)

357-P. **Impurity Band Conduction in Germanium and Silicon.** Esther M. Conwell. *Physical Review,* v. 103, ser. 2, July 1, 1956, p. 51-61.

Theoretical discussion. (P15, Ge, Si)

358-P. **Galvanomagnetic Theory for Electrons in Germanium and Silicon: Magnetoresistance in the High-Field Saturation Limit.** Louis Gold and Laura M. Roth. *Physical Review,* v. 103, ser. 2, July 1, 1956, p. 61-66.

For constant scattering time r and ellipsoidal energy surfaces, the Boltzmann transport equation reduces to a phenomenological equation of motion for electrons from which a conductivity tensor is derived. (P15, P16, Ge, Si)

359-P. **Electrical Conduction in Magnesium Stannide at Low Temperatures.** H. P. R. Frederikse, W. R. Hosler and D. E. Roberts. *Physical Review,* v. 103, ser. 2, July 1, 1956, p. 67-72.

Measurements of conductivity, Hall effect and magnetoresistance in the helium range suggest that conduction takes place in a surface layer rather than in the bulk of the sample. (P15, Mg, Sn)

360-P. **Scattering of Electrons From Clustered Vacancies in Copper.** D. L. Dexter. *Physical Review,* v. 103, ser. 2, July 1, 1956, p. 107-110.

Excess resistivity and resistivity per unit stored energy calculated. (P15, Cu)

361-P. **Possible Approach to the Low-Temperature Resistance Maximum in Dilute Alloys of Transition Metals in Noble Metals.** R. W. Schmitt. *Physical Review,* v. 103, ser. 2, July 1, 1956, p. 83-87.

The temperature at which the maximum occurs varies rapidly with concentration of the transition metal. The magnetoresistance is negative up to some temperature higher than the temperature at which the maximum in resistivity occurs. (P15, P16, EG-c)

362-P. (English.) **The Magnetic Properties of Chromium-Tellurium-Selenium System.** Ichiro Tsubokawa. *Physical Society of Japan, Journal,* v. 11, No. 6, June 1956, p. 662-665.

The change of magnetic properties due to the replacement of tellurium by selenium in chromium telluride. (P16, Cr, Te, Se)

363-P. (English.) **The Magnetic Properties of $FeSe_x$ With the NiAs Structure.** Tokutaro Hirone and Shu Chiba. *Physical Society of Japan, Journal,* v. 11, No. 6, June 1956, p. 666-670.

The phase diagram investigated by means of X-ray and thermal analyses in the composition region in which ferrimagnetism is supposed to occur. (P16, Fe, Se)

364-P. (Book.) **Encyclopedia of Physics. v. XIX. Electrical Conductivity. Pt. I.** S. Flügge, editor. 411 p. 1956. Springer-Verlag, Berlin, Germany.

Reviews on electronic structure of solids, experimental metallic conductivity, electrical and thermal conductivity theory in metals and photoconductivity. (P15)

Q

Mechanical Properties and Test Methods; Deformation

572-Q. **Buckling of Columns in the Presence of Creep.** Sharad A. Patel. *Aeronautical Quarterly,* v. 7, May 1956, p. 125-134.

Instantaneous elastic and plastic deformations, as well as transient and secondary creep, are considered. Formulas for the critical time at which a column fails are presented for integral values of the exponents appearing in the creep law. Table, graphs, diagram. 8 ref. (Q3)

573-Q. **The Growth of Fatigue Cracks.** A. K. Head. *Commonwealth of Australia, Dept. of Supply, Aeronautical Research Laboratories, Report no.* MET. 5, July 1954, 48 p.

A theoretical analysis for the growth of a fatigue crack based on an idealized form of crack indicates that it would be quite feasible for the fatigue crack to have been growing during most of the fatigue life. Graphs, diagrams. 40 ref. (Q7, Q26)

574-Q. **Brazed Titanium Lap Joint. Mechanical Properties. Oxy-Acetylene Torch Heated.** L. D. Girton. *Convair, Report No.* 8333, Jan. 1955, 7 p.

Shear strength and ductility of joints brazed with fine silver, 52S aluminum, and 70% zinc, 30% silver alloy. Penetration depth of fine silver and 52S aluminum into joints. Diagrams, tables. (Q2, Q23, K8, Ti)

575-Q. **Effect of Hydrogen on Stretching of Titanium.** W. L. Moore and L. F. Vobeyda. *Convair, Report No.* 9280, Mar. 1955, 13 p.

The variation of elongation in long strip specimens of three titanium materials when stretched to failure. Micrographs, graphs, tables. (Q23, Ti)

576-Q. **Silver Brazed Titanium Alloys. Mechanical Properties. Torch and Furnace Heated.** A. J. Brothers and L. D. Girton. *Convair, Report No.* 9371, Apr. 1955, 10 p.

Torch and furnace brazing characteristics; wettting and flowing characteristics of fine silver melted on titanium in argon. Diagrams, tables. (Q general, K8, Ag, Ti)

577-Q. **Metallurgical Examination of Titanium Alloy Part, 8-73702, Broken During Machining.** H. C. Turner. *Convair, Report No.* 9459, Nov. 1955, 11 p.

No definite metallurgical cause of failure was established. Table, photographs, micrographs. (Q26, Ti)

578-Q. **Annealing of Titanium Alloy Extrusion RS-140X.** H. C. Turner. *Convair, Report No.* 9760, Aug. 1955, 3 p.

Effect of annealing on the tensile properties of ⅝-in. round RS-140X titanium extruded bar. Table. (Q27, J23, Ti)

579-Q. **Mechanical Properties of Resistance Heated, Hot-Stretch-Formed Titanium Alloy Sheet.** H. C. Turner. *Convair, Report No.* 9877, Oct. 1955, 6 p.

Effect of hot stretch forming on the tensile and compression properties of titanium alloy sheet. Tables. (Q27, Q28, G9, Ti)

580-Q. **Ductile Chromium.** W. H. Smith and A. U. Seybolt. *Electrochemical Society, Journal,* v. 103, June 1956, p. 347-352.

Effects of certain impurities on the room temperature ductility of chromium. Graphs, micrograph. 10 ref. (Q23, Cr)

581-Q. **The Criterion for the Cleavage Fracture of Zinc Single Crystals.** A. Deruyttere and G. B. Greenough. *Institute of Metals, Journal,* v. 84, May 1956, p. 337-345 + 1 plate.

Stresses and deformation at fracture determined for long crystals of zinc. Observations on stress-strain curves included. Diagram, graphs, tables, photograph. 21 ref. (Q26, Q27, Zn)

582-Q. A Theory of the Yield Point and the Transition Temperature of Mild Steel. F. Forscher. *Journal of Applied Mechanics,* v. 23, June 1956, p. 219-224.

Theoretical derivation and correlation of the strain-rate effect, temperature effect, the yield-delay phenomenon, the tri-axiality and their interaction on the yield point. Graphs. 35 ref. (Q23, ST)

583-Q. Comparison of Slip-Line Solutions With Experiment. E. G. Thomsen. *Journal of Applied Mechanics,* v. 23, June 1956, p. 225-230.

Plane-strain and axially symmetric approximate solutions for a perfect plastic compared with experimental results obtained from the extrusion of a billet of commercially pure aluminum. Graphs, diagram. 13 ref. (Q24, F24, Al)

584-Q. Theory of Mechanical Damping Due to Dislocations. A. Granato and K. Lücke. *Journal of Applied Physics,* v. 27, June 1956, p. 583-593.

Theory provides a quantitative interpretation of stain-amplitude dependent hysteresis loss. Table, graphs, diagrams. 17 ref. (Q8, M26)

585-Q. Hardness Plateaus and Twinning in Steel by Explosives With Lined Cavities. Sampooran Singh, N. R. Krishnaswamy and A. Soundraraj. *Journal of Applied Physics,* v. 27, June 1956, p. 617-620.

Changes in hardness and microstructure in annealed low-carbon steel caused by jets squirted from high explosives with steel-lined conical cavities. Micrographs, graph, table. 14 ref. (Q29, Q24, M27, CN)

586-Q. Effect of Nuclear Radiation on Structural Materials. J. C. Wilson and D. S. Billington. *Journal of Metals,* v. 8, May 1956, p. 665-672.

Choice of construction materials for high flux regions of reactors is complicated by difficult and costly experimentation required to determine radiation effects and interrelationship of structural properties in irradiated metals. Tables, graphs. 28 ref. (Q general)

587-Q. Effects of Alloying Elements on Plastic Deformation in Aluminum Single Crystals. E. E. Underwood and L. L. Marsh, Jr. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 477-483.

Aluminum single crystals, alloyed with 0.042 at. % copper and 0.11 at.% magnesium were subjected to constant-stress creep tests, tensile tests and hot hardness measurements within a temperature range of 300 to 866° K. Graphs. 27 ref. (Q24, Al)

588-Q. Tensile Characteristics of Particle-Strengthened Alloys of Zirconium With Iron. J. H. Keeler. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 486-491.

The absolute increase in strength due to particle strengthening, although decreasing with increasing temperature, was a greater percentage at high temperature. Micrographs, graphs, tables. 19 ref. (Q27, Fe, Zr)

589-Q. Some Transient Effects During Creep and Tensile Tests of an Aluminum Alloy. H. A. Lequear and J. D. Lubahn. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 497-501.

A specially devised test shows that the nature of the previous steady-state conditions, which a sudden change in strain rate disturbs, is one of the factors affecting transient behavior. Tables, graphs, diagrams. 9 ref. (Q3, Q27, Al)

590-Q. Hydrogen Embrittlement of a Commercial Alpha-Beta Titanium Alloy. E. J. Ripling. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 502-503.

Embrittlement was attenuated if the hydrogen content was high, or eliminated when the hydrogen content was only moderate, by stretching at a high strain rate. Diagrams. 8 ref. (Q23, Q24, Ti)

591-Q. Heat Treatment and Mechanical Properties of Ti-Fe Alloys. F. C. Holden, H. R. Ogden and R. I. Jaffee. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 521-528.

The properties of quenched alloys were correlated with their microstructures. A comparison of specimens having equiaxed α-β structures with those having acicular α-β structures shows that equiaxed specimens have better tensile ductility, but lower impact resistance. Both strength and ductility are lowered by heat treatments below 700° C. Table, micrograph, graphs. 5 ref. (Q23, J26, J29, Fe, Ti)

592-Q. Strain-Induced Porosity and Hydrogen Embrittlement in Zirconium. F. Forscher. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 536-543.

Results suggest that strain-induced porosity results with hydride initially present, or, in material containing less than 50 ppm. hydrogen with hydride precipitated by strain aging. Diagrams, tables, micrographs, photograph, graphs. 12 ref. (Q23, N7, Zr)

593-Q. Mechanism of Intercrystalline Fracture. H. C. Chang and Nicholas J. Grant. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May, 1956, p. 544-551.

On the basis of microscopic observations during creep tests and a knowledge of the interaction between grains and grain boundaries, a mechanism of intercrystalline fracture and propagation of the fracture is proposed. Micrographs, diagrams. 18 ref. (Q26, Q3)

594-Q. Sulfur Embrittlement of Cobalt. D. L. Martin. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 578-579.

Alloys evaluated for hot brittleness by heating to 1000° C. in a hydrogen furnace and swaging in air. Graph, table, micrographs, photograph. 13 ref. (Q23, Co)

595-Q. Fracture of Magnesium Alloys at Low Temperature. Frank E. Hauser, Philip R. Landon and John E. Dorn. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 589-593.

The flow and fracture strengths of polycrystalline aggregates of high-purity magnesium and a solid solution of aluminum in magnesium determined as functions of temperature and grain size. Graphs, tables, diagram. 10 ref. (Q26, Mg)

596-Q. Influence of Order-Disorder on Creep of Beta Brass. M. Herman and N. Brown. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, May 1956, p. 604-606.

The creep strength increased as the amount of long range order increased. Graphs. 9 ref. (Q3, N10, Cu)

597-Q. Friction in a Close-Contact System. Walter Claypoole. *Mechanical Engineering,* v. 78, June 1956, p. 529-532.

Fundamental aspects of problem and experimental evidence supporting new inferences with regard to friction. Diagram, graphs, photograph, micrograph. (Q9)

598-Q. Design of High-Temperature Alloys—Cermets and Oxide Dispersions. Nicholas J. Grant. *Metal Progress,* v. 69. June 1956, p. 76-80.

The best alloys now known are based on cobalt and nickel, the first age hardened by carbide dispersion and the second by $Ni_3(Al, Ti)$ compound. Pure metals, refractory and ductile, may be strengthened by oxide dispersions or used as binders for hard, brittle particles. Micrographs, graphs, tables. (Q general, SG-h, C-n, Co, Ni)

599-Q. Effect of Temperature on Strength-Weight Ratio of Aircraft Materials. *Metal Progress,* v. 69, June 1956, p. 80-B.

Curves for various titanium, stainless steel, magnesium, molybdenum and Inconel alloys. Graph. (Q23, Ni, Ti, SS, Mg, Mo)

600-Q. High-Temperature Alloys for Jet-Engine Buckets. (Digest of "Wrought Jet Engine Bucket Alloys", by Stephen G. Demirjian, presented at Detroit Technical Meeting of Society of Automotive Engineers, January 1956.) *Metal Progress* v. 69, June 1956, p. 198, 200, 202.

Cobalt and nickel-base alloys are being studied for possible improvements in properties. Forging procedures discussed. (Q general, F22, Co, Ni)

601-Q. Dislocation Theories of Strength and Plasticity. A. V. Stepanov. *Research,* v. 9, June 1956, p. 227-236. (Translated from *Bulletin of the Academy of Sciences of the U. S. S. R.,* v. 18, Sept. 1954, p. 90.)

The fundamental principles underlying existing dislocation theories discussed and criticized; an alternative approach to the study of strength and plasticity of crystals proposed. Diagrams. 13 ref. (Q23, Q24, M26)

602-Q. Fatigue Failures. Charles M. Schwartz. *SAE Journal,* v. 64, June 1956, p. 49.

Fatigue failures appear to be related to "mistakes" in the crystal structure of a ductile metal. The relationship between fatigue failures and imperfections in the crystal might be deduced from correlation of X-ray measurements of atoms dislocated by microstresses from their ideal position in the crystal lattice with fatigue data. (Q7, M26)

603-Q. Properties of Some Tungsten and Titanium Steels Containing Boron. A. Bannerjee, D. K. Sood and P. Mehta. *TISCO,* v. 3, Apr. 1956, p. 53-62.

Effect of boron on the properties of low-carbon, low-alloy steels. Similarity in the effects of molybdenum, tungsten and titanium in boron-treated steels. Precipitation hardening in molybdenum-boron steels and their weldability. Micrographs, diagrams, graphs, tables. 25 ref. (Q general, J27, K9, AY)

604-Q. (English.) **An Experimental Investigation on the Mode of Slip in α-Brass.** H. Wilsdorf and J. T. Fourie. *Acta Metallurgica,* v. 4, no. 3, May 1956, p. 271-288.

It is concluded that slip is inhomogeneous. Tables, graphs, micrographs, diagrams. 9 ref. (Q24, Cu)

605-Q. (English.) **Internal Friction in Solid Solutions of Tantalum.** R. W. Powers and Margaret V. Doyle. *Acta Metallurgica,* v. 4, no. 3, May 1956, p. 233-242.

Experimental evidence that concentration broadening in oxygen-tantalum solutions is brought about by an interaction between interstitial oxygen atoms. Graphs, tables. 5 ref. (Q22, Ta)

606-Q. (English.) **On the Role of Grain Boundaries in Creep.** M. R. Achter and R. Smoluchowskii. *Acta Metallurgica,* v. 4, no. 3, May 1956, p. 331-332.

Rate of creep is influenced by the availablity of dislocations and the ease with which they can move across the grain boundary. Graph, diagram. 2 ref. (Q3, M26)

607-Q. (German.) **Contributions to a Theory of Plastic Strain of Wires.** Horst Lippmann. *Acta Metallurgica,* v. 4, no. 3, May 1956, p. 298-305.

Equations for spontaneous elongation and creep behavior. Taylor's theory of work-hardening. Graphs. 12 ref. (Q24, Q3)

608-Q. (German.) **The Behavior of a Welded Aluminum Alloy of the AlZn-Mgl Type.** A. Müller-Busse. *Aluminium,* v. 36, no. 6, June 1956, p. 333-339.

Data on static and fatigue strengths show that considerable use of the alloy for welded structures in the future can be predicted. Photographs, micrographs, graphs, tables. (Q23, Q7, K9, Zn, Mg, Al)

609-Q. (German.) **Behavior of Impact-Loaded Light Metal Welds Under a Consideration of Low Temperatures and Different Impact Rates.** M. Puschner. *Aluminium,* v. 36, no. 6, June 1956, p. 340-343.

Dependance of impact value on temperature and rate of impact. Graphs, tables, photographs, oscillograms. (Q6, Mg, Al)

610-Q. (German.) **Dislocation Damping of Aluminum Single Crystals at Room Temperature.** Wolfgang Kempe and Ekkehart Kröner. *Zeitschrift für Metallkunde,* v. 47, no. 5, May 1956, p. 302-304.

Measurements indicate that attenuation of pure aluminum at room temperature in the kc. zone is chiefly due to dislocations. Graphs, diagram. 7 ref. (Q8, M26, Al)

611-Q. (German.) **Effect of Load on X-Ray Determined Bending Yield Stress.** Eckard Macherauch. *Zeitschrift für Metallkunde,* v. 47, no. 5, May 1956, p. 312-330.

Steels of different consistency and duralumin were subjected to bending with, and without, impact repetitive stress. Elongation was measured mechanically and by X-ray. Tables, graphs, diagrams, photograph. 61 ref. (Q5, Al, ST)

612-Q. (German.) **Tensile Deformation of Copper Single Crystals. I. Plastic Stress-Strain Curves and Surface Phenomena.** Jörg Diehl. *Zeitschrift für Metallkunde,* v. 47, no. 5, May 1956, p. 331-343.

The consolidation curve is divided into three zones which follow different laws and which differ in their dependence on crystal orientation. Micrographs, tables, graphs, diagrams. 53 ref. (Q27, Q24, Cu)

613-Q. **Studies of Factors Affecting Thermal Stability of Titanium-Base Alloys.** *Battelle Memorial Institute, Second Progress Report for Wright Air Development Center Contract No.* AF 33(616)-3208, Apr. 1956, 6 p.

Initial tensile tests on Ti-6Al-4V and Ti-155-A show lowest strengths obtained were on samples fabricated and annealed in the beta field and highest strengths were obtained on samples fabricated in the beta field and annealed in the alpha-beta field. (Q27 Ti)

614-Q. **Heat Treatment of 6Al-4V Titanium Alloy (1675° F. Solution Heat Treatment.)** S. Guintoli and H. C. Turner. *Convair, Report No.* 56-85, Apr. 1956, 5 p.

Determines effect of solution heat treating at 1675° F. for 1 hr., water quenching, and aging at 900° F. on mechanical properties, and the reproducibility of mechanical properties obtained with the heat treatment when applied to various heats of the alloy. (Q25, J27, J26, Ti)

615-Q. **Correlation of Hydrogen Content to Tensile and Fatigue Properties in Heliarc-Welded A-110AT Titanium Alloy Sheet.** *Convair, Report No.* 56-189, Apr. 1956, 7 p.

No exact correlation could be found. (Q27, K1, Q7, Ti)

616-Q. **Creep and Stress-Rupture Properties of Zirconium. Effect of Annealing Treatment.** R. W. Guard and J. H. Keeler. *General Electric Research Laboratory, Report No.* 56-RL-1541, May 1956, 17 p.

Significant creep does not occur at stresses below the yield strength at temperatures below 300° C. The effect of annealing treatments is significant only at 500° C. Twinning is prominent at 300° C. and below, while polygonization and boundary deformation are important at 500° C. (Q3, Q4, J23 Zr)

617-Q. **Experiences in the Heating of Steel.** W. Trinks. *Industrial Heating,* v. 23, June 1956, p. 1221-1222, 1224, 1226.

Comments on the rate at which steels of various compositions and sizes can be heated without the formation of cracks. (Q26, J general, ST)

618-Q. **Stress at Low Temperatures.** H. G. Baron. *Iron and Steel Institute, Journal,* v. 29, June 1956, p. 243-249.

Curves for some metals and alloys at high rates of strain. (Q25, Al, Cu, ST)

619-Q. **Yield at Low Temperatures.** H. F. Hall and R. W. Nichols. *Iron and Steel Institute, Journal,* v. 29, June 1956, p. 249-252.

Properties of some carbon and low-alloy steels. (Q23, Q25, Cu, Al, ST)

620-Q. **Hardness at Low Temperatures.** R. W. Nichols. *Iron and Steel Institute, Journal,* v. 29, June 1956, p. 253-256.

Tests with pyramid and ball indentors. (Q29, ST)

621-Q. **Carbon Steel Wire.** R. W. Nichols. *Iron and Steel Institute, Journal,* v. 29, June 1956, p. 256-262.

Effects of low temperature on the tensile, fatigue and reverse-bend strength of steel wire, and the influence of electro-galvanizing on these properties. (Q general, L17, Zn, CN)

622-Q. **Manganese-Molybdenum Steels.** N. P. Allen and C. C. Earley. *Iron and Steel Institute, Journal,* v. 29, June 1956, p. 262-267.

Effect of phosphorus on impact value. (Q6, AY)

623-Q. **Boron-Treated Steel.** Samuel J. Rosenberg and John D. Grimsley. *Iron and Steel Institute, Journal,* v. 29, June 1956, p. 267-274.

A study of the impact properties. (Q6, AY-h)

624-Q. **Intergranular Fracture in Steel Castings.** *Journal of Steel Castings Research,* no. 5, May 1956, p. 10-14.

Nitrogen and aluminum in steel; fractography of commercial steels; effect of heat treatment. (To be continued.) (Q26, M23, J general)

625-Q. **Relative Load Change of Compression and Extension Springs Due to Certain Dimensional Variations.** *Mainspring,* v. 16, no. 7, June 1956, 4 p.

Mathematical relationships are graphed to show the relative load change due to the magnitude of major variables: wire diameter, coil diameter, number of active coils and deflection from free length. (Q21)

626-Q. **The Lowering of Fracture-Stress Due to Surface Adsorption.** N. J. Petch. *Philosophical Magazine,* v. 1, 8th ser., no. 4, Apr. 1956, p. 331-337.

Gibbs' adsorption equation and the Griffith and dislocation theories of fracture are used to calculate this lowering. (Q26, P13)

627-Q. **Magnetic Anisotropy and Cold Worked Texture of Titanium.** J. Reekie and Y. L. Yao. *Physical Society, Proceedings,* v. 69, no. 436B, Apr. 1956, p. 417-431.

Knowing magnetic anisotropy, it is possible to estimate texture in a specimen of cold worked or annealed metal from susceptibility measurements made in three orthogonal directions. (Q24, P16, Ti)

628-Q. **High-Temperature Vacuum Furnace for Tensile Testing.** E. A. Smith and R. W. Guard. *Review of Scientific Instruments,* v. 27, June 1956, p. 386-387.

A resistance furnace using a tantalum tube heater was constructed for testing wire specimens of metals that require protection from the atmosphere at temperatures up to 1600° C. (Q27)

629-Q. **Hardness Testing. I.** Vincent E. Lysaght. *Steel,* v. 138, June 25, 1956, p. 98-100, 102.

Vickers, Rockwell and Brinell hardness testers compared. (Q29)

630-Q. **Hardness Testing. II. Microhardness Methods.** Vincent E. Lysaght. *Steel,* v. 139, July 2, 1956, p. 72-73.

Microhardness tests are best for electroplatings and hard, thin surface coatings, also good for determining limits of decarburization. (Q29)

631-Q. **Surfaces Can Be Too Smooth.** C. R. Lewis and A. L. Thomson. *Tool Engineer,* v. 37, July 1956, p. 113-116.

Effects of finish on wear and frictional properties. Finish quality beyond the point of utility is uneconomical. (Q9, G19)

632-Q. **Effect of Rapid Heating and Cooling on the Hardness and Strength of 2014-T6 and 7075-T6 Aluminum Alloys.** W. K. Smith. *U. S. Naval Ordnance Test Station, Navord Report* 5065, Apr. 1956, 12 p.

The alloys, used in rocket motor tubes, were heated at 165° F. per sec. and air cooled. Hardness was measured immediately and 100 hr. after the heating and cooling cycle. Maximum temperatures of local areas of the fired motor tubes can be estimated from hardness values. Graphs. 2 ref. (Q29, Q23, Al)

633-Q. Evaluation of the Significance of Charpy Tests for Quenched and Tempered Steels. P. P. Puzak and W. S. Pellini. *Welding Journal,* v. 35, June 1956, p. 275s-290s.

High-strength steels tested to determine critical fracture transition temperatures at which welded structures, loaded in the presence of sharp, crack-like defects, may initiate or propagate brittle fractures. (Q23, ST)

634-Q. Some Dynamic Mechanical Properties of Heat Treated Low-Alloy Weld Deposits. E. H. Franks and W. H. Wooding. *Welding Journal,* v. 35, June 1956, p. 291s-297s, 307s.

Nickel-molybdenum-vanadium deposits are of good quality, have excellent ductility and show exceptional endurance limits under cycles of reversed stress. (Q23, K1, AY)

635-Q. Fatigue Strength of Welds in Low-Alloy Structural Steels. J. E. Stallmeyer, G. E. Nordmark, W. H. Munse and N. M. Newmark. *Welding Journal,* v. 35, June 1956, p. 298s-307s.

For all types of specimens tested, there is little difference in the fatigue strengths. (Q7, K1, AY)

636-Q. Proper Fabrication Tames Titanium Embrittlement. Andrew N. Eshman. *Western Metals,* v. 6, June 1956, p. 69-71.

Methods for controlling the three types of embrittlement. (Q23, Ti)

637-Q. Intermittent Stressing and Heating of Aircraft Structural Metals. J. F. Hanlon and G. J. Guarnieri. *Cornell Aeronautical Laboratory, Inc.,* Reports for Apr. 30, 1954 and Dec. 31, 1954. Contract No. AF33(161)-2226. 19 p. and 20 p.

Determination of creep-rupture characteristics of RC-130-A under conditions of constant temperature-constant load, and creep rupture behavior of RC-70 under intermittent heating and loading conditions. (Q3, Ti)

638-Q. Tensile Properties of Aircraft-Structural Metals at Various Rates of Loading After Rapid Heating. *Southern Research Institute, Fourteenth Progress Report to Wright Air Development Center,* Contract No. AF 33(616)-424, Jan. 1956, 29 p.

Tabular presentation of tensile properties of stainless steels and heat-resisting alloys under various conditions of temperature, strain rate and holding time. (Q23, Ti, SS, SG-h)

639-Q. (English.) **Formation of Blisters in Iron.** F. De Kazinczy. *Jernkontorets Annaler,* v. 140, no. 5, 1956, p. 347-359.

Hydrogen pressure required for formation of cracks was determined in iron with low carbon and oxygen contents. (Q23, Q26, N1, Fe)

640-Q. (German.) **Hardness and Wear Resistance of Electrolytic Silver Coatings.** R. Weiner and E. Brosch. *Metalloberflache,* v. 10, no. 6, June 1956, p. 164-167.

Shows no direct relation between indentation hardness and wear resistance. Mechanical properties of various electrolytic silver coatings are similar. (Q29, Q9, L17, Ag)

641-Q. (German.) **On the Hot-Brittleness of Copper.** W. Engelhardt and F. Neuberger. *Neue Hütte,* v. 1, no. 6, May 1956, p. 339-343.

Tensile strength, breaking elongation and reduction of the fracture area of copper. Uniform elongation and local elongation. Test of a copper deoxidized with phosphorus. (Q23, Q27, Q26, Cu)

642-Q. (Italian.) **Internal Friction: A New Physical Quantity for the Study of Metals.** T. Federighi. *Alluminio,* v. 25, no. 5, May 1956, p. 225-230.

Essential characteristics of internal friction are illustrated, with explanation of the physical significance as well as methods of measurement. (Q22)

643-Q. (Russian.) **Influence of Oxidation Films on the Adsorption Effect Facilitating Plastic Deformation of Polycrystalline Aluminum.** Iu. V. Goriunov and B. Ia. Iampol'skii. *Doklady Akademii Nauk SSSR,* v. 107, no. 6, June 1956, p. 827-829.

Experiments showing that natural oxidation films on the surface of metals reduce the absorptive effect of media employed to lower the surface tension of the metal and to facilitate its deformation. (Q24, Al)

644-Q. (Russian.) **Mechanism of the Effect of Small Amounts of Phosphorus and Molybdenum on the Temper Brittleness of Steel.** V. I. Arkharov, S. I. Ivanovskaia, N. M. Kolesnikova and T. A. Fofanova. *Fizika Metallov i Metallovedenie,* v. 2, no. 1, 1956, p. 57-65 plus 1 plate.

Types of cracks, impact toughness, chemical analyses. Metallurgical investigation of diffusion front during diffusion of phosphorus in chromium-nickel and chromium-nickel-molybdenum steels. (Q23, Q6, N1, AY)

645-Q. (Russian.) **Effect of "Rest" on the Strength of Quench-Hardened Steel and Its Tendency to Delayed Fracture.** S. S. Shurakov. *Fizika Metallov i Metallovedenie,* v. 2, no. 1, 1956, p. 66-77 plus 1 plate.

The "rest" is the period of time elapsing between quenching and beginning of testing. Increasing rest time increases strength and plasticity in the case of the usual static-load tests and decreases tendency to delayed fracture. (Q23, Q26, J26, CN)

646-Q. (Russian.) **Strength of Quenched Steel.** A. Nemchinskii and N. Fokina. *Fizika Metallov i Metallovedenie,* v. 2, no. 1, 1956, p. 78-87.

Effect of rate of cooling during quenching, time until start of testing, and length of time of load on strength. Rate of surface cooling in relation to coefficient of heat transfer. (Q23, J26, CN)

647-Q. (Russian.) **Basic Formulas for Calculations in the Range of Finite Elastoplastic Deformations.** G. P. Zaitsev. *Fizika Metallov i Metallovedenie,* v. 2, no. 1, 1956, p.120-124.

Formulas determining relation of differences of principal stresses to the differences of the corresponding principal elongations or angular deformations are a consequence of the application of the principle of superposition. (Q21, Q24, Q23, Q25, Q2)

648-Q. (Russian.) **Finite Elastoplastic Angular Deformations (Shears) in the Basis-Type, Logarithmic, and Other Systems of Magnitudes.** *Fizika Metallov i Metallovedenie,* v. 2, no. 1, 1956, p. 125-136.

The system of variable magnitudes is called a "basis-type" if the absolute increases of these magnitudes are compared with their original values. Problem of so-called true elongations or shears. (Q21, Q24, Q2)

649-Q. (Russian.) **Character of Yield Point With Tension.** Ia. B. Gurevich. *Fizika Metallov i Metallovedenie,* v. 2, no. 1, 1956, p.137-141.

Elastic limit and discontinuous yield point. Size of plateaus for discontinuous yield point, mechanical properties of steels melted under vacuum and in air. Effect of nonmetallic inclusions, including gases. (Q23, ST)

650-Q. (Russian.) **Effect of Rate and Degree of Plastic Strain on Relaxation and Subsequent Deformability of Metals. I-II.** L. I. Vasil'ev, L. M. Butkevich, E. I. Orekhov and L. A. Spevak. *Fizika Metallov i Metallovedenie,* v. 2, no. 1, 1956, p. 142-148.

Relaxation and tension curves, deformation at low and high temperatures, load conditions and time factor in relation to formation and release of deformations. (Q27, Q3, Q23, Sn, Cu, Al, Pb)

651-Q. (Russian.) **Experimental Determination of the Properties of Incomplete Elasticity of Spring Materials.** S. O. Tsobkallo. *Fizika Metallov i Metallovedenie,* v. 2, no. 1, 1956, p. 149-159.

Present-day methods of measuring elastic fatigue and elastic limit. Relation of deformation to time in testing for elastic fatigue. Role of intermediate loads. (Q21, SG-b)

652-Q. (Russian.) **Effect of Plastic Deformation on the Modulus of Elasticity of Low-Carbon Steel.** V. I. Korotkov. *Fizika Metallov i Metallovedenie,* v. 2, no. 1, 1956, p. 160-167.

Effect of cold plastic deformation and of heat treatment on Young's modulus and shear modulus of plastically deformed steel. (Q21, Q2, J general, CN)

653-Q. (Russian.) **Nonhomogeneity of Deformation in Plastic Compression. I.** G. I. Karpov. *Fizika Metallov i Metallovedenie,* v. 2, no. 1, 1956, p. 168-171.

During the plastic compression of cylindrical specimens, there is a great deal of nonhomogeneity both in the deformation and cold hardening of various parts of the specimen. Method of secondary compression is used. (Q28, Q24, Cu)

654-Q. (Russian.) **Distribution of Deformations During Compression of Cylinders at a High Rate. II.** G. I. Karpov. *Fizika Metallov i Metallovedenie,* v. 2, no. 1, 1956, p. 172-175.

Compression is carried out at a rate of 100 meters per sec. Patterns of distribution are attributable to forces of inertia and unevenness of rate of deformation throughout the specimen. (Q28, Q24, Cu)

655-Q. (Russian.) **Problem of Relation Between Hardness and Composition of Dilute Solid Solutions.** V. P. Shishokin and V. A. Ageeva. *Fizika Metallov i Metallovedenie,* v. 2, no. 1, 1956, p. 176-180.

Study of hardness at different temperatures and rates of deformation. Hardness is determined by two factors: relation of volumes of particles and the mutual polarization action of particles. (Q29, N12, Bi, Pb, Sn, Hg, Cd)

656-Q. (Russian.) **Erosion Wear of Metals and Protection by Coatings.** A. V. Shreider. *Fizika Metallov i Metallovedenie,* v. 2, no. 1, 1956, p. 181-188.

Criteria and characterization of resistance of materials to erosion-abrasive wear, including factors of hardness of metal, surface condition, speed of flight and angle of fall of particles. (Q9, L19, Al, Cu, Mg, Fe)

657-Q. (Russian.) **Creep of Aluminum Under a Dynamic Load.** A. A. Predvoditelev and B. A. Smirnov. *Moskovskogo, Universiteta, Vestnik, Seriia Fiziko-Matematicheskikh i Esterstvennykh Nauk,* v. 2, no. 3, Mar. 1956, p. 51-55.

Creep tests of aluminum under pulsating dynamic loads show sharp increase in creep, similarity between dynamic and static creep curves,

and conformity of experimental with theoretical data which permits explaining results by an intensification of slide processes in metallic grains under a dynamic load. (Q3, Al)

658-Q. (Swedish.) **Influence of Boron on Tensile Strength and Structure of Black-Heart Malleable Iron.** Gustaf Ostberg. *Gjuteriet,* v. 46, no. 5, May 1956, p. 72-76.

The tendency of boron to lower tensile strength, yield point and elongation is attributed to the shape of the graphite flakes and their distribution in the microstructure. (Q27, Q23, M27, N8, CI)

659-Q. (Swedish.) **Importance of the Surface Effect on the Initiation of Fatigue Cracks.** *Jernkontorets Annaler,* v. 140, no. 5, 1956, p. 360-372.

Fatigue experiments on three carbon steels and one chromium-nickel steel indicate a surface effect which appears to contribute to the initiation of fatigue cracks. (Q7, ST)

660-Q. Some Aspects of the Problem of Fatigue. F. J. Hiorns. *British Coal Utilization Research Association, Monthly Bulletin,* v. 20, Apr. 1956, p. 153-160.

Factors influencing the fatigue strength of materials; propagation of fatigue cracks; nature of the fatigue process; fatigue in brittle materials. (Q7)

661-Q. Photoelastic Analysis of Stresses in the Detachable Rock Bit. Shoji Shimamura and Morio Jido. *Journal of Mechanical Laboratory (Japan),* v. 1, 1955, p. 15-16.

Photoelastic fringe patterns show stress distribution. (Q25, AY)

662-Q. Fundamental Study on Manufacturing Standard Block for Hardness Measurement. III. The Effect of Subzero-Treatment Conditions on the Hardness Distribution. Tetsutaro Mitsuhashi, Manabu Ueno and Shin Yokoi. *Journal of Mechanical Laboratory (Japan),* v. 1, 1955, p. 16-18.

Hardness was increased by subzero-treatment, but the relation between subzero-treatment method and the increment of hardness was not clear. (Q29, J26)

663-Q. Effect of Carbon on Some Properties of Ti-Mo Alloys. D. W. Levinson, W. Rostoker and A. Yamamoto. *Journal of Metals, v. 8; American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, June 1956, p. 790-793.

Influence of carbon on tensile strength tensile ductility, transformation kinetics and grain growth characteristics. (Q23, N3, N6, Ti, Mo)

664-Q. The Measurement of Frictional Forces at Vibrating Contacts. J. S. Halliday. *Journal of Scientific Instruments,* v. 33, June 1956, p. 213-217.

A simple machine used for the investigation of wear phenomena. (Q9)

665-Q. Investigating the Strength of Copper-Brazed Joints. R. C. Grassi, I. Cornet and R. S. Berger. *Mechanical Engineering,* v. 78, July 1956, p. 630-632.

The high strength of a copper-brazed joint may be attributed to a greater work hardening capacity of the thin braze metal under restraint, in conjunction with an increase in the strength of the copper-braze metal due to alloying with iron. (Q2, K8, Cu, CN)

666-Q. An Oblique Illuminator for Use in Hardness Testing. S. A. Dunk. *Metallurgia,* v. 53, no. 320, June 1956, p. 289-291.

Construction and applications. (Q29)

667-Q. Slow-Cooling Cracks a Carburizing Problem. T. W. Ruffle and P. C. Kirby. *Metal Treatment and Drop Forging,* v. 23, June 1956, p. 237-242.

Maximum carbon content in the case should be kept as low as practicable. More rapid cooling from carburizing either by direct air cooling or oil quenching will almost certainly eliminate cracking. (Q26, J28, ST)

668-Q. Elastic Moduli of Indium Antimonide. Roy F. Potter. *Physical Review,* v. 103, ser. 2, July 1, 1956, p. 47-50.

Elastic constants for the semiconductor indium antimonide measured as a function of temperature, using the composite resonator technique. (Q21, Sb, In)

669-Q. Investigation of the Effect of Impact Damage on Fatigue Strength of Jet-Engine Compressor Rotor Blades. Albert Kaufman and André J. Meyer, Jr. *U. S. National Advisory Committee for Aeronautics, Technical Note* 3275, June 1956, 25 p.

The most serious damage was nicks at blade edges. The farther the damage was from the maximum-vibratory-stress section of the airfoil and from the edges, the less detrimental it was. (Q7, Q6)

670-Q. (Czech.) **Steel for Ball Bearings.** Vladimir Dusek. *Hutnik,* v. 6, no. 1, Jan. 1956, p. 9-11.

Requirements for steels, effect of nonmetallic inclusions, including oxygen and hydrogen, on strength and impact toughness, comparison of ball-bearing steels from the basic electric furnace and the openhearth basic or acid furnaces. (Q23, Q29, T7, Q6, ST)

671-Q. (Japanese.) **Study on the Toughness Improvement by Addition of Small Amounts of Ferro-Titanium in Structural Steel. I.** Toshio Saito. *Iron & Steel Institute of Japan, Journal,* v. 42, no. 6, June 1956, p. 490-495.

Examination of ingots showed that titanium was more effective than molybdenum or vanadium in alloy steel, decreased brittleness in manganese steels, produced fine austenite grains in any steel, was not recommended for plain carbon steels, but was extremely effective for Ni-Cr-Mo structural steels. (Q23, D general, ST)

672-Q. (Japanese.) **Mechanical Properties of S816 at Elevated Temperature. I.** Taro Hasegawa, Osamu Ochiai and Junichi Ino. *Iron & Steel Institute of Japan, Journal,* v. 42, no. 6, June 1956, p. 498-502.

Effect of solution-treatment temperature and aging on the creep rupture characteristics at 732° C and 26.6 kg. per sq. m.m. (Q3, AY)

673-Q. (German.) **Effect of the Sulfur in the Furnace Atmosphere on Behavior in the Deformation of Plain Carbon Steels.** Kurt Born. *Stahl und Eisen,* v. 76, no. 13, June 28, 1956, p. 789-799.

Hot bending tests after annealing in sulphur-free and sulphur-containing furnace gases. Effects of copper and tin contents. (Q24, J23, Q5, CN)

674-Q. (Russian.) **Heat Resistance and Relaxation Resistance of Chromium-Vanadium and Chromium-Tungsten-Vanadium Structural Steels.** L. Ia. Liberman and A. V. Boeva. *Metallovedenie i Obrabotka Metallov,* 1956, no. 4, Apr. 1956, p. 2-10.

Impact toughness after high and cyclic tempering with rapid and slow cooling. Effect of lengthy soaking and heat treatment variations on mechanical properties. Effect of content of alloying elements and carbon on creep resistance and long-time strength. (Q3, Q23, J29, AY-n)

675-Q. (Russian.) **Variation in the Fatigue Limits of Aluminum Alloys Under the Influence of Anodic Oxidation.** A. V. Shreider, A. V. Bialobzheskii, Z. T. Zagritsenko and B. V. Serebrennikov. *Metallovedenie i Obrabotka Metallov,* 1956, no. 4, Apr. 1956, p. 14-20.

Chromic acid anodizing increases endurance and strength. Investigation on the effect of sulphuric acid anodizing on fatigue limits, and effect of oxide coating thickness and polishing. (Q7, L19, Al)

676-Q. (Russian.) **Investigation of Irreversible Temper Brittleness of Alloyed Ferrite.** M. M. Shteinberg, V. D. Sadovskii and A. V. Demakova. *Metallovedenie i Obrabotka Metallov,* 1956, no. 4, Apr. 1956, p. 21-25.

Relation of impact toughness and hardness to tempering temperatures in alloy steels. Theories consider role of retained austenite, formation of carbides, and evolution of chromium and manganese nitrides during tempering. (Q23, J29, N8, AY)

677-Q. (Russian.) **Mechanical Properties of Sheets From Continuous Castings.** N. L. Komandin, I. E. Kurov and I. I. Vedeniapina. *Metallovedenie i Obrabotka Metallov,* 1956, no. 5, May 1956, p. 12-15.

In sheets rolled from continuous castings, mechanical properties are distributed more evenly, and plasticity and ductility are somewhat higher than in sheets from ordinary ingots. (Q general, D9)

678-Q. (Russian.) **The Ductility-Semibrittleness Transition Point in Structural Steel.** I. E. Kontorovich and B. M. Voshedchenko. *Metallovedenie i Obrabotka Metallov,* 1956, no. 5, May 1956, p. 19-24.

Influence of various heat treatment procedures. (Q23, J general, ST)

679-Q. (Russian.) **Mechanical Nature of Temper Brittleness.** G. V. Uzhik and A. A. Zuikova. *Metallovedenie i Obrabotka Metallov,* 1956, no. 4, Apr. 1956, p. 26-34.

Observations of tough and brittle states and stages of development of cracking in notched specimens subject to bending and impact tests. Stage of initial plastic deformation. Varying capacity of materials to resist development of cracking already begun. (Q23, Q5, Q6, ST)

680-Q. (Russian.) **The Effect of Cold Treatment on the Properties of High-Alloy Steels.** M. A. Balter. *Metallovedenie i Obrabotka Metallov,* 1956, no. 5, May 1956, p. 33-40.

Effect of treatment, below freezing point, on certain properties of carburized high alloy steel, is compared with a procedure employing annealing at 650° C. between carburization and hardening. (Q general, J26, AY)

681-Q. (Russian.) **Sulfide Treatment of Chromium Stainless Steels.** E. P. Pukhovskii, P. A. Zakharova, N. A. Shpigunova and G. P. Budaev. *Metallovedenie i Obrabotka Metallov,* 1956, no. 5, May 1956, p. 40-43.

Sulphide treatment is found to reduce wear of stainless steel very substantially and also reduces wear of other steels to a considerable extent. (Q9, ST, SS)

682-Q. (Russian.) **Residual Stresses at the Junction of Two Hardened Layers.** G. F. Golovin. *Metallovedenie i*

Obrabotka Metallov, 1956, no. 5, May 1956, p. 43-47.

A study of distribution of residual stresses over a surface depending on various hardening procedures. Suggests undesirability of surface treatment by separate hardening of adjacent layers. (Q25)

683-Q. (Russian.) **Variation of Yield Points and Strength in Relation to Amount of Reduction During Cold Rolling of Thin Stainless-Steel Ribbon.** A. V. Tret'iakov. *Metallovedenie i Obrabodka Metallov,* 1956, no. 4, Apr. 1956, p. 56-58.

Yield points and resistance time for three steels in tensometric tests. (Q23, SS)

684-Q. (Russian.) **A Method of Evaluating the Hydrogen Embrittlement in Steel.** M. A. Figel'man and A. V. Shreider. *Zavodskaia Laboratoriia,* v. 22, no. 5, May 1956, p. 586-588.

A device for cyclic bend testing of hydrogen absorbing steels. (Q5, ST)

R
Corrosion

308-R. Corrosion Studies Pertinent to Bromine Trifluoride Processes. J. G. Schnizlein, R. K. Steunenberg and R. C. Vogel. *Argonne National Laboratory (U. S. Atomic Energy Commission),* ANL-5557, Apr. 1956, 27 p.

The corrosion rates of certain metals and alloys were determined in several solutions typical of bromine trifluoride processes. Photographs, tables, graphs, diagram. 3 ref. (R5, Al, Mg, ST, Ag, Ni)

309-R. All-Glass Multiple-Test Apparatus for Corrosion Testing of Stainless Steels. J. V. Alger, E. C. Roberts, R. P. Lent and G. W. Anderton. *ASTM Bulletin,* no. 214, May 1956, p. 57-60.

Apparatus appears to be capable of fulfilling a role in the field of quality control of corrosion resistant steels and has advantages of convenience of operation, adaptability and lowered construction cost. Diagrams, graphs, tables. 4 ref. (R11, SS)

310-R. A New Atmospheric Cycling Test for Corrosion Study. T. J. Nussdorfer and D. O. White. *ASTM Bulletin,* no. 214, May 1956, p. 61-65.

Apparatus designed to simulate the daily cycling of atmospheric conditions was used to evaluate volatile corrosion inhibitors and preservative oils in reciprocating and turbojet engines. Graphs, photographs. 7 ref. (R11, R10)

311-R. Zinc Anodes for Ships. H. S. Preiser. *Bureau of Ships Journal,* v. 2, June 1956, p. 15-17.

Iron impurity was found to be the controlling factor in the ability of zincs to sustain continuous activity. Maximum iron that can be tolerated is 0.0014%. Diagrams, graph. (R10, Zn)

312-R. Waterside Corrosion in Naval Boilers. W. Tessin. *Bureau of Ships Journal,* v. 2, June 1956, p. 18-20.

Dissolved oxygen, main cause of corrosion, can be eliminated by mixing with superheated steam. Photographs. (R4)

313-R. Corrosion in Caustic of Nickel-Iron Welds Obtained in Fabrication of Nickel-Clad Vessels. Paul J. Gegner. *Corrosion,* v. 12, June 1956, p. 261-262.

Tests indicate that in nickel-clad vessels for caustic service, iron can be tolerated in the welds up to about 25% insofar as corrosion is concerned. Tables. (R5, Ni, Fe)

314-R. Corrosion Testing of Aluminum. I. High Velocity Test Method in Aqueous Solutions. Sumner B. Twiss and Jack D. Guttenplan. *Corrosion,* v. 12, June 1956, p. 263-269; disc., p. 270.

A technique involving spinning of aluminum disks in aqueous solutions at high velocities was used to investigate the effect of various natural waters and antifreezes on aluminum corrosion. Table, graphs, diagram, photographs, micrograph. 8 ref. (To be continued.) (R11, R5, Al)

315-R. Iron in Oil Technique as a Corrosion Control Criterion. R. G. Rydell and W. H. Rodewald. *Corrosion,* v. 12, June 1956, p. 271-276.

The Walker-Robertson method of determining the amount of iron in oil is suitable for processing a relatively large number of samples with acceptable accuracy; appears to be valuable corrosion control criterion for sour wells. Tables, photographs. (R10, Fe)

316-R. A Radiochemical Tracer Investigation of the Role of Mercury in the Corrosion of Aluminum. R. C. Plumb, M. H. Brown and J. E. Lewis. *Corrosion,* v. 12, June 1956, p. 277-285.

Technique permitting accurate quantitative measurements of mercury pickup. Mechanism by which aluminum corrodes in a solution of mercuric salt. Technique for removing mercury contamination from aluminum. Photographs, table, diagrams, graphs, autoradiograms. 6 ref. (R5, R11, Hg, Al)

317-R. Inhibiting Corrosion of Steel, Aluminum, and Magnesium Intermittently Exposed to Brines. George E. Best and John W. McGrew. *Corrosion,* v. 12, June 1956, p. 286-292.

Chromate effectively minimizes corrosion of mild steel and selected aluminum and magnesium alloys at ordinary temperatures. Graphs, tables, diagrams. 9 ref. (R10, R5, ST, Al, Mg)

318-R. The Scaling of Titanium and Titanium-Base Alloys in Air. Hal W. Maynor, Jr., and Roy E. Swift. *Corrosion,* v. 12, June 1956, p. 293-304.

Scaling tendencies of various alloys relative to titanium and stainless steel evaluated on the basis of weight gain with time. Isothermal transitions in scaling rate were observed within the temperature range from 1200 to 1600° F. Graphs, diagrams, photographs, tables. 11 ref. (R3, Ti)

319-R. High Pressure Oxidation of Niobium. Donald W. Bridges and W. Martin Fassell, Jr. *Electrochemical Society, Journal,* v. 103, June 1956, p. 326-330.

Niobium oxidizes according to the linear rate law from 400-800° C. The oxidation rate is extremely pressure sensitive above 550° C. Tables, graphs. 18 ref. (R2, Cb)

320-R. Inhibition of Iron Dissolution in Acid Solutions. Cecil V. King and Eric Rau. *Electrochemical Society, Journal,* v. 103, June 1956, p. 331-337.

Inhibition of iron dissolution from rotating cylinders studied in solutions of dilute hydrochloric or perchloric acid with excess nitrate as depolarizer. No better over-all oxidizing inhibitor than dichromate was found. Photographs, graphs, tables. 23 ref. (R10, R5, Fe)

321-R. Cathodic Protection Reaches Up to Cover the Splash Zone. Maurice A. Riordan. *World Oil,* v. 142, June 1956, p. 250 + 4 pages.

A jacket made from molding plaster, gypsum and fresh water creates an environment that will support proper current flow. Photographs, diagrams. 1 ref. (R10)

322-R. Continuous Dissolution of Uranium-Aluminum Reactor Fuels. A. F. Boeglin, J. A. Buckham, L. Chajson, R. B. Lemon, D. M. Paige and C. E. Stoops. *A.I.Ch.E. Journal,* v. 2, June 1956, p. 190-194.

Extensive pilot plant studies of the continuous mercury-catalyzed nitric acid dissolution of uranium-aluminum alloy materials similar to possible reactor fuel elements were carried out. (R2, U, Al)

323-R. Apparatus for Visual Study of Corrosion by Hot Water. Daniel R. Grieser and Eugene M. Simons. *A.I.Ch.E. Journal,* v. 2, June 1956, p. 215-218.

A windowed autoclave was designed to provide a pictorial representation of the corrosion phenomenon while it is occuring. The instrument affords a relative evaluation of the influence of such variables as geometry, alloying, type of bonding, water temperature and water impurities on corrosion rate. (R4, R11)

324-R. Corrosion Problems in Oil Refining. R. M. Robb. *Australasian Engineer,* v. 48, Apr. 1956, p.48-53.

Basic mechanism of corrosion resulting from petroleum products; general corrosion economy and refinery technology; common methods of prevention. (R7)

325-R. The Corrosion of Cast Iron. R. I. Higgins. *British Cast Iron Research Association, Journal of Research and Development,* v. 6, Feb. 1956, p. 165-177 + 2 plates.

The behavior and suitability of different types of cast iron in various conditions and media of corrosion. (R general, CI)

326-R. Electrode Potentials and the Dissolution of Gold. G. Thomas. *Canada, Department of Mines and Technical Surveys, Mines Branch, Technical Paper No.* 9, 1954, 14 p.

The potential of a metal electrode in a cyanide solution depends not only on the cyanide concentration, but also on pH, on the amounts of dissolved gold and oxygen, and on salts which may be present. (R2, P15, Au)

327-R. Corrosion Experience With a Modern Salt Evaporator. R. B. Richards. *Chemical Engineering Progress,* v. 52, June 1956, p. 58, 62.

Corrosion at tube junctions with the head resulting from insufficient rolling complicated this new and otherwise successful installation. (R5)

328-R. Corrosion Keys. Aluminum. R. S. Dalrymple. *Chemical Processing,* v. 19, July 1956, p. 80.

Data on corrosion rates with various chemicals. (R5, Al)

329-R. Corrosion and Construction Problems of Sulphuric Acid Plant. G. C. Lowrison and F. Heppenstall. *Corrosion Technology,* v. 3, June 1956, p. 174-180.

Methods and materials of construction used in the manufacture of sulphuric acid from the handling and storage of raw materials to the acid concentration stage. (R6, R5, T29)

330-R. Corrosion of Packaged Articles. F. A. Paine. *Corrosion Technology,* v. 3, June 1956, p. 191-193.

Factors influencing selection of packaging method. (R10)

331-R. Spread of Protection. J. H. Morgan. *Corrosion Technology,* v. 3, June 1956, p. 194-196.

Analysis of three types of control ensuring complete cathodic protection. (R10)

332-R. Paint-Zinc Combinations for Corrosion Protection of Iron & Steel. E. E. Halls. *Electroplating and Metal Finishing,* v. 9, June 1956, p. 186-187.

Results of outdoor exposure tests. (R3, L26, Zn, Fe, ST)

333-R. Interaction of Chromium (VI) Anions With Chromium Metal Surfaces. Sherman Kottle and L. O. Morgan. *Journal of Physical Chemistry,* v. 60, June 1956, p. 738-741.

Electrode potential changes are correlated with adsorption chromium anions on a chromium metal surface. Three classes of chromium metal surfaces were recognized. (R5, L17, Cr)

334-R. Corrosion as It Affects Insulator and Conductor Hardware. A. W. Bardeen and J. M. Sheadel. *Power Apparatus and Systems,* no. 24, June 1956, p. 491-498; disc., p. 498-501.

The different types of corrosion observed on insulators and hardware of power lines described and classified; remedial measures suggested. (R3)

335-R. Study of the Feasibility of Aqueous Recovery of Spent Fuels. I. Dissolution Experiments on Alloy Samples. Philip J. Elving, John L. Griffin and John O. Larson. *University of Michigan, Engineering Research Institute, (U. S. Atomic Energy Commission),* AECU-3160, June 1954, 20 p.

Variation of extent of dissolution; time required for complete disintegration and completion of dissolution; kinetic experiments. (R2)

336-R. (Czech.) **Corrosion Protection of Parts by Means of Vapor-Phase Inhibitors.** L. Cerveny. *Strojirenstvi,* v. 6, no. 1, Jan. 1956, p. 44-47.

Properties and technology of vapor-phase inhibitors. Tests of the effectiveness of dicyclohexylaminenitrite as a rust inhibitor, under chemical industry, marine, and other conditions. (R10)

337-R. (Dutch.) **I. Theory of Electrochemical Corrosion of Metals. II. Review of Methods for Combatting It.** J. W. Boon. *Metaalinstituut T. N. O.,* no. 36, Oct. 1955, p. 687-696.

Electrochemical corrosion fundamentals; methods of corrosion prevention; metal passivation. (R1, R10)

338-R. (Dutch.) **Corrosion Tests With Aluminum Alloys.** E. M. J. Mulders, W. G. R. de Jager and J. W. Boon. *Metaalinstituut T. N. O.,* no. 25, Feb. 1956, p. 44-58.

Outdoor exposure tests and laboratory tests were performed with a large number of specimens bonded by various methods as well as with aluminum alloys combined with steel. (R3, ST, Al)

339-R. (Dutch.) **Cathodic Protection of Underground Pipe Lines.** J. F. Bogtstra and M. Oudeman. *Metaalinstituut T. N. O.,* no. 35, July 1955, 41 p.

Electrochemical attack and other factors affecting the corrosion of pipe lines. (R10)

340-R. (French.) **A Survey of Recent Work of the Corrosion Committee of the Association Belge pour l'Etude, l'Essai et l'Emploi des Matériaux (A.B.E.M.).** G. Depireux. *Acier, Stahl, Steel,* v. 21, no. 5, May 1956, p. 220-224.

Work has been directed chiefly towards protection of metal structures against atmospheric corrosion, and is based mainly on natural aging tests. (R3)

341-R. (German.) **Our Contemporary Conception of Electrochemical Mechanism of Corrosion.** I. W. Schwarz. *Metall,* v. 10, nos. 11-12, June 1956, p. 513-519.

Chemical and electrochemical corrosion; physical and chemical effects; hydrogen and oxygen corrosion. (R1)

342-R. (German.) **Corrosion, Fissuring, and Erosion of the Outside Surface of Copper Alloy Condensers. I.** F. W. Nothing. *Metall,* v. 10, nos. 11-12, June 1956, p. 520-523.

Corrosion produced by condensates or cooling agents. General material wear. Selective corrosion. (R2, R4, Cu)

343-R. (Hungarian.) **Electrochemical Investigation of the Corrosion Resistance of Tin Coatings.** Mihaly Solti, Laszlo Kiss and Antal Vigh. *Magyar Kemiai Folyoirat,* v. 62, no. 4, Apr. 1956, p. 130-135.

An electrographic method using fixed photographic paper was developed to determine porosity of tin coatings, to predict corrosion resistance. Tin plate corrodes in sodium chloride and acetic acid solutions. (R11, R5, L16, Sn)

344-R. (Russian.) **The Kinetics of Cathodic Processes Involved in the Corrosion of Metals in the Soil.** N. D. Tomashov and Iu. N. Mikhailovskii. *Doklady Akademii Nauk SSSR,* v. 107, no. 6, June 1956, p. 853-856.

Study of migration of oxygen in soil yields quantitative data for determining rate of cathodic processes responsible for corrosion of metals in various soils. (R8)

345-R. (Russian.) **The Corrosion of Lead in Sulfuric Acid as Influenced by the Structure of the Metal.** M. A. Dasoian. *Doklady Akademii Nauk SSSR,* v. 107, no. 6, June 1956, p. 863-866 + 1 plate.

Experimental data on the mechanism of action of various anticorrosion additives in lead. (R5, R6, Pb)

346-R. (Russian.) **Rust Inhibitors in Lubricating Oils for Periodically Operated Working Machines.** B. V. Losikov and L. A. Aleksandrova. *Vestnik Mashinostroeniia,* v. 36, no. 5, May 1956, p. 12-15.

An experimental study of a number of rust-preventing additives for lubricating oils. Efficacy of the additives depends on the shape and positions of parts lubricated. (R10)

347-R. (Russian.) **Investigation of the Corrosion Resistance of Solid Solutions of Metals. I. The System In-Pb.** N. N. Gratsianskii and M. L. Kaplan. *Zhurnal Fizicheskoi Khimii,* v. 30, no. 3, Mar. 1956, p. 651-659.

In the case of low-melting solid solutions in which at room temperature the atoms possess a high diffusion velocity, a limit is observed to the corrosion resistance. (R5, N12, In, Pb)

348-R. (Russian.) **A Study of Metal Corrosion With the Aid of the Heavy Oxygen Isotope. I. Moist Atmosphere Corrosion of Iron.** A. I. Brodskii, A. S. Fomenko and T. M. Abramova. *Zhurnal Fizicheskoi Khimii,* v. 30, no. 3, Mar. 1956, p. 676-684.

Role of electrochemical and chemical mechanisms in the moisture corrosion of iron. (R11, R5. R1, Fe)

349-R. (Ukrainian.) **Changes in the Corrosion Reesistance of Hardened Steel Due to Annealing.** K. F. Starodubov and S. G. Cherniavs'ka. *Dopovidi Akademii Nauk, Ukrains'koi RSR,* 1956, no. 2, p. 140-142.

Experimental data on variation of corrosion resistance of carbon steel with temperature of annealing. Corrosion curve shows two sharp maxima at about 275 and 400° C. (R general, J23, CN)

350-R. Suggested Nontechnical Manual on Corrosion for Water Works Operators. Lee B. Hertzberg. *American Water Works Association, Journal,* v. 48, June 1956, p. 719-738.

Types of corrosion, costs, insulation, pipe fittings, painting and coating, bonding, cathodic protection and pipeline selection. (R4, R10, L26)

351-R. Kinetics of the Reaction Between Thorium and Water Vapor. Bruce E. Deal and Harry Svec. *Ames Laboratory (U. S. Atomic Energy Commission),* ISC-653, June 1955, 50 p.

Examination of the reaction between 200 and 600° C. and at water vapor pressures of 40, 70, and 100 m.m. hg. Photo. (R4, Th)

352-R. Stress-Corrosion Cracking Test. A. W. Dana and W. B. DeLong. *Corrosion,* v. 12, July 1956, p. 309T-310T.

Experimental apparatus and procedure for studying effect of thermal insulation on cracking of austenitic stainless steel equipment. (R1, SS)

353-R. Corrosion Testing of Aluminum. II. Development of a Corrosion Inhibitor. Samner B. Twiss and Jack D. Guttenplan. *Corrosion,* v. 12, July 1956, p. 311T-315T; disc., p. 315T-316T.

An accelerated corrosion test was used to test effectiveness of various corrosion inhibitors in tap water. Soluble oil was most effective. (R11, R10, Al)

354-R. The Cathodic Protection of Metallic Structures in Marine Environments. W. A. Bowen, Jr. *Corrosion,* v. 12, July 1956, p. 317T-321T.

Theoretical and practical considerations involved, including anode location, polarization, economics and other factors. Methods of checking the effectiveness of cathodic protection. Automatic control system. (R10)

355-R. Cathodic Protection of Lead Cables in an Urban Area. L. M. Plym. *Corrosion,* v. 12, July 1956, p. 331T-335T.

Establishment of a protection system for lead covered telephone cables. Practical applications for system arrangements: distributed ground beds, forced current through a drainage system, distributed negative connections to several underground cables and duct anodes. (R10, Pb)

356-R. Fundamentals of Liquid Metal Corrosion. W. D. Manly. *Corrosion,* v. 12, July 1956, p. 336T-342T.

Types of corrosion, influencing variables, role of impurities, mass transfer. (R6)

357-R. The Effect of Iron in Galvanic Zinc Anodes in Sea Water. R. B. Teel and D. B. Anderson. *Corrosion,* v. 12, July 1956, p. 343T-349T.

Zinc containing an iron concentration higher than 0.0015% will develop a high resistance corrosion product film which will render the zinc less effective as an anode material. (R10, Fe, Zn)

358-R. Use of Organic Corrosion Inhibitor in Refining Processes. Charles Fiske and Paul Mernitz. *Corrosion*, v. 12, July 1956, p. 350T-354T.

Use of 6-8 p.p.m. of inhibitor has extended life of tower several years beyond that expected with ammonia protection alone. (R10)

359-R. Cathodic Protection of Lead Sheathed Cables in the Utilities Industry. *Corrosion*, v. 12, July 1956, p. 355T-370T.

Replies to two questionnaires concerning lead and copper-jacketed cables are summarized. Includes protective criteria, ground bed design and location, power source, insulating joints and protective coatings. Table, graphs. 5 ref. (R10, Pb)

360-R. A Nondestructive Test for Intergranular Corrosion in Stainless Steel Tubing. R. C. Robinson. *E. I. du Pont de Nemours & Co., Savannah River Laboratory Technical Division (U. S. Atomic Energy Commission)*, DP-153, Mar. 1956, 15 p.

An eddy current instrument which indicates the relative degree of intergranular corrosion present in austenitic stainless steel tubes. (R11, R2, SS)

361-R. High Temperature Scaling of Nickel-Manganese Alloys. E. B. Evans, C. A. Phalnikar and W. M. Baldwin, Jr. *Electrochemical Society, Journal*, v. 103, July 1956, p. 367-375.

At a given temperature, the scaling rate increased with increasing additions of manganese. Composition of both the external and subscale was dependent on alloy composition and temperature. (R2, Ni, Mn)

362-R. Pitting Corrosion of 18Cr-8Ni Stainless Steel. M. A. Streicher. *Electrochemical Society, Journal*, v. 103, July 1956, p. 375-390.

Factors controlling pitting corrosion and laboratory methods used for its study. Influence of alloying elements added to 18 Cr-8 Ni stainless steel on pit initiation in sodium chloride and bromide solutions. (R11, R5, R2)

363-R. Studies of the Corrosion Resistance of Titanium Alloys I. Corrosion Resistance of Ti-Al and Ti-Ni Alloys. Susumu Yoshida, Shigetake Okamoto and Takashi Araki. *Journal of Mechanical Laboratory (Japan)*, v. 1, 1955, p. 33-34.

Corrosion rates were determined in various test solution at ordinary and boiling temperatures. (R5, R11, Ti)

364-R. Corrosion Resistance of Aluminum Alloys. F. M. Reinhart and G. A. Ellinger. *Light Metal Age*, v. 14, June 1956, p. 16-17.

Effects of composition, heat treatment and protective coatings on corrosion rates. (R3, Al)

365-R. Effect of Hardening and Tempering on the Corrosion Resistance of 13%-Cr Steel. E. A. Oldfield and G. B. Graves. *Metal Treatment and Drop Forging*, v. 23, June 1956, p. 211-215.

Influence of tempering time and temperature on resistance to corrosion by a dilute aqueous solution of nitric and hydrochloric acids. (R5, Q29, J29, AY-c)

366-R. Oxidation Characteristics of the Alkali Metals. I. Oxidation Rate of Sodium Between −79 and 48° C. J. V. Cathcart, L. L. Hall and G. P. Smith. *Oak Ridge National Laboratory (U. S. Atomic Energy Commission)*, ORNL-2054, June 1956, 7 p.

The reaction rate in dry oxygen was found to be small, and the oxide films were highly protective. The observed oxidation data could not be fitted to any of the conventional oxidation rate equations. (R2, EG-e)

367-R. (Russian.) **Causes of Fissure Formation in E1257 Steel Pipes of Steam Superheaters.** L. P. Trusov, L. P. Nikitina and G. A. Tuliakov. *Metallovedenie i Obrabotka Metallov*, 1956, no. 5, May 1956, p. 27-33.

Mechanism of fissure formation in pipes of certain types of steam superheaters operating under irregular conditions. (R1, AY)

368-R. (Pamphlet.) **Literature Survey of the Corrosion Behavior of Tantalum, Zirconium, and Titanium.** R. A. Perkins. 23 p. 1955. Metals Research Laboratories, Electro Metallurgical Co., Niagara Falls, N. Y.

Applications of tantalum in chemical equipment and corrosion applications probably will depend to a large extent on other metals which can compete in specific applications. Notable among these are titanium and zirconium, both of which exhibit exceptionally good corrosion resistance to a wide variety of chemicals and are available at far less cost. A search of the literature has been made to determine the specific fields in which each excels and those in which they compete. Typical data on corrosion behavior are summarized in this report. (R general, Ta, Zr, Ti)

S

Inspection and Control

360-S. Determination of "Active" Sulfur Content of Sulfur-Bearing Cutting Fluids. O. L. Brandes. *ASTM Bulletin*, 1956, no. 214, May 1956, p. 28-30.

Tests followed Federal Specification VV-0-283. Results of participating laboratories were in general agreement. Tables. (S11, G21)

361-S. Instruments for Pyrometry. Leo Walter. *British Steelmaker*, v. 22, June 1956, p. 164-166.

Survey of recently developed instruments for indicating, recording and controlling temperatures. Photographs, diagrams. (S16)

362-S. Surface Inspection of Hot Rolled Coil Rod and Bars. William C. Campbell. *Iron and Steel Engineer*, v. 33, May 1956, p. 55-57; disc., p. 58-59.

Inspection practices applied to steel for use in cold heading and cold forming such products as bolts and nuts. Photographs. (S13, ST)

363-S. New Standards Aid Selection of Die Casting Alloys. *Machine Design*, v. 28, June 14, 1956, p. 112.

A report on eight new standards for aluminum, magnesium and brass alloys. Table. (S22, E13, Al, Mg, Cu)

364-S. Russians Use Tagged Isotopes to Study Steelmaking. *Metal Progress*, v. 69, June 1956, p. 62-65.

Radioactive elements used to study passage of stock through blast furnaces, wear of refractories, refining reactions in steelmaking and origin of inclusions in ball bearing steel. Graph. (S19, D general, ST)

365-S. Analytical Determination of Trace Constituents in Metal Finishing Effluents. XV. The Colorimetric Determination of Cyanates in Effluents. D. G. Gardner, R. F. Muraca and E. J. Serfass. *Plating*, v. 43, June 1956, p. 743-746.

Method gave satisfactory results in the presence of 100 p.p.m. of each of 23 elements and ammonium, cyanide and thiocyanate ions in simultaneous admixture. 5 ref. (S11, L17)

366-S. Complexometric Determination of Copper in Copper Cyanide-Rochelle Salts Plating Baths. Clarence E. Gehrand. *Plating*, v. 43, June 1956, p. 747.

Procedure makes use of disodium dihydrogen ethylene-diaminetetracetate dihydrate, using Murexide as an indicator and allows production of plating solution with known copper content. 4 ref. (S11, L17, Cu)

367-S. Stainless and Heat-Resisting Steels. A. J. Turnell. *Welding and Metal Fabrication*, v. 24, June 1956, p. 214-216.

U. S. specifications and their British equivalents. Tables. (S22, SS-h)

368-S. Electrolytic Separation and Volumetric, Absorptiometric and Coulometric Estimation of Thallium. William T. Foley and Roswell F. Pottie. *Analytical Chemistry*, v. 28, July 1956, p. 1101-1104.

Equipment and procedures. (S11, T1)

369-S. Isolation and Measurement of Uranium at the Microgram Level. Charles L. Rulfs, Anil K. De and Philip J. Elving. *Analytical Chemistry*, v. 28, July 1956, p. 1139-1143.

A double cupferron separation of uranium using extraction was adapted to the micro level. (S11, U)

370-S. Assay for Platinum Metals in Ores and Concentrates. K. Hoffman, A. D. Westland, C. L. Lewis and F. E. Beamish. *Analytical Chemistry*, v. 28, July 1956, p. 1174-1177.

Data indicate that no advantage is to be gained by elaborate, time-consuming leaching methods prior to fire assay. (S11, Pt)

371-S. Simple Indicator Method for Determination of Aluminum. R. V. Paulson and J. F. Murphy. *Analytical Chemistry*, v. 28, July 1956, p. 1182-1184.

Volumetric method used for control of aluminum concentration in solutions used in finishing aluminum. (S11, L general, Al)

372-S. Improved Spot Test for Boron and a Quantitative Estimation of Boron in Very Dilute Solutions. T. S. Burkhalter and Dixon W. Peacock. *Analytical Chemistry*, v. 28, July 1956, p. 1186-1188.

Test using sorbitol combines ease of procedure, reproducibility and high sensitivity. (S11, B)

373-S. Fire Assay for Platinum. I. Hoffman and F. E. Beamish. *Analytical Chemistry*, v. 28, July 1956, p. 1188-1193.

Distribution of platinum during the various processes involved in a fire assay examined. Acceptable over-all recoveries were obtained except where the slags contained considerable nickel. (S11, Pt)

374-S. The Determination of Thorium in Ores by the Column Method. R. J. Guest. *Canada, Department of Mines and Technical Surveys, Mines Branch Technical Paper No.* 1, 1953, 24 p.

Thorium is selectively extracted from ores with ethernitric solvent through a column of activated alumina and activated cellulose. Specimens having a thorium content of less than 0.1% can be determined colorimetrically. (S11, Th)

375-S. The Colorimetric Determination of Copper With 2,2-Diquinolyl in

Minerals and Ores. R. J. Guest. *Canada, Department of Mines and Technical Surveys, Mines Branch, Technical Paper No.* 3, 1953, 18 p.

Cuproine forms an intensely colored purple complex with cuprous ions. The color of the complex bears a linear relationship to the copper present. (S11, Cu)

376-S. The Determination of Aluminum by the Fluorophotometric Method. J. B. Zimmerman. *Canada, Department of Mines and Technical Surveys, Mines Branch, Technical Paper No.* 4, 1953, 12 p.

Impurities in samples in solution are precipitated with sodium hydroxide. An aliquot containing soluble sodium aluminate is adjusted to pH 4.6, 8-hydroxy-quinoline is added and the complex aluminum 8-hydroxyquinolate is extracted with chloroform and measured fluorimetrically at 560 mu. (S11, Al)

377-S. The Determination of Uranium in Concentrates by the Fluorophotometric Method. J. B. Zimmerman, F. T. Rabbitts and E. D. Kornelsen. *Canada, Department of Mines and Technical Surveys, Mines Branch, Technical Paper No.* 6, 1953, 9 p.

Fluorophotometric method has been extended to the analysis of gravity and chemical concentrates for uranium. A modified micropipette is used to minimize pipetting errors. A good statistical average is obtained from a large number of determinations. (S11, U)

378-S. Testing and Inspection of Materials and Welded Work for Hydraulic Power Plants. W. Stauffer and A. Keller. *Escher Wyss News,* v. 29, Jan.-Apr. 1956, p. 35-48.

Consideration is given to design, fabrication and examination of welded steel sections. (S13, K1, ST)

379-S. Evaluation of Valve Mechanical Characteristics. J. T. Ward and Otto Kneisel. *Instruments and Automation,* v. 29, June 1956, p. 1121-1123.

Some common tests used to evaluate control-valve mechanical characteristics; casting and and forging inspection, stem finish, actuator rating, actuator leakage and body rating. (S14, S13)

380-S. Cracking of DTD.247. M. H. Davies. *Iron & Steel,* v. 29, June 1956, p. 321-322.

Investigation of failure in a high thermal expansion alloy. Use of annealed drawn tubes, or full annealing of machined tubes subsequent to machining recommended.
(S21, Q26, SG-s)

381-S. International Standards for Wrought Light Alloys. III. French Standards. *Light Metals,* v. 19, June 1956, p. 185-186.

Terminology, classification, composition limits, mechanical properties, dimensional tolerances, testing and marking. (To be continued.)
(S22, Al)

382-S. Measurement and Control of the Temperature of Moving Parts. I. D. A. Senior. *Machinery Lloyd (Overseas Ed.)* v. 28, June 9, 1956, p. 70-74.

Thermal expansion devices, thermo-electric devices and resistance thermometers considered. (S16)

383-S. Surface Roughness and the Design Engineer. Joseph Manuele. *Magazine of Standards,* v. 27, June 1956, p. 167-171, 190-191.

Development of surface roughness standards. (S15, S22)

384-S. Wall Thickness of Tubing Gaged by Weight. *Metal-Working,* v. 12, July 1956, p. 10-11.

Control of stainless steel hypodermic needle tubing. (S14, SS)

385-S. Getting More Range From an Air Gauge. L. E. Abbott and A. F. Pomeroy. *Metalworking Production,* v. 100, June 8, 1956, p. 708-710.

Mechanism for checking drawn tubing for microwave equipment will indicate 0.005 in. above and below nominal dimension. (S14)

386-S. Raw Materials Development Laboratory Handbook of Analytical Methods. Michael A. DeSesa. *National Lead Company, Inc., Raw Materials Development Laboratory (U. S. Atomic Energy Commission),* TID-7002, Mar. 1956, 117 p.

Compilation of 34 tested methods related to uranium processing.
(S11, U)

387-S. Nondestructive Testing on the Southern Pacific Railroad. A. S. Pedrick. *Nondestructive Testing,* v. 14, May-June 1956, p. 10-13, 16.

Application of magnetic-particle inspection, radiography, ultrasonic technique and black light to railroad maintenance. Use of reflectoscope.
(S13)

388-S. Measurement of Coating Thicknesses by Use of Pulsed Eddy Currents. Donald L. Waidelich. *Nondestructive Testing,* v. 14, May-June 1956, p. 14-16.

Theoretical considerations; equipment used. (S14, L22)

389-S. Characteristics of a Closed-Link Television X-Ray Inspection System. D. Polansky and E. L. Criscuolo. *Nondetructive Testing,* v. 14, May-June 1956, p. 18-21.

Outstanding features are its ability to present an image at very low intensities and the fact that it is a filmless method of inspection that can be used throughout the complete X-ray energy range. (S13)

390-S. SIMAC-Sonic Inspection, Measurement, and Control. F. E. Pringle, Jr. *Nondestructive Testing,* v. 14, May-June 1956, p. 22-25; 28.

Searching units, transmitter equipment, receiver and methods of presentation (audible by meter, cathode-ray equipment or recorder); possibility of automation in such testing. (S13)

391-S. Application of Nondestructive Testing in the Manufacture of Aviation Gas Turbine Engines. F. W. Rohde. *Nondestructive Testing,* v. 14, May-June 1956, p. 26-28.

Testing of raw materials; testing during manufacture, assembly, operation and service life. (S13)

392-S. A Scintillation Count-Rate Meter for Gamma Radiation. Jerome G. Morse and Arthur W. Kneibler, Jr. *Nondestructive Testing,* v. 14, May-June 1956, p. 30-32.

Instrument surpasses the Geiger-Muller tube in sensitivity, mechanical strength, inherent versatility and accuracy, and requires less time for resolution. (S13)

393-S. Non-Destructive Testing. G. H. Thurston. *Western Machinery and Steel World,* v. 47, June 1956, p. 78-80.

Use of photographic and visual aids in helping the production executive determine exactly what he is doing with machines and processes. (S15, S13)

394-S. (English.) **Separation and Identification of Molybdenum and Tungsten.** L. C. F. Blackman. *Mikrochimica Acta,* 1956, no. 9, p. 1366-1368.

A simple and rapid ring-oven method. (S11, Mo, W)

395-S. (English.) **Studies on Flame Spectrochemical Analysis. III. Determination of Magnesium in Aluminium Alloy.** Shigero Ikeda. *Science Reports of the Research Institutes, Tohoku University,* ser. A, v. 8, no. 1, Feb. 1956, p. 9-13.

Magnesium can be determined in presence of large amounts of aluminum. (S11, Mg, Al)

396-S. (English.) **Studies on Gas Analysis in Metallic Titanium.** Hirdehiro Goto, Shin Suzuki and Akira Onuma. *Science Reports of the Research Institutes, Tohoku University,* ser. A, v. 8, no. 1, Feb. 1956, p. 24-30.

Determination of hydrogen, oxygen and nitrogen in metallic titanium studied by vacuum fusion and chlorination methods. (S11, Ti)

397-S. (Czech.) **Quality of Razor Blades.** Mir. Korinek and F. Beran. *Strojirenstvi,* v. 6, no. 1, Jan. 1956, p. 39-44.

Manufacturing method, inspection, determination and control of quality. Study of sharpness and its geometry. Microstructure and micro-smoothness.
(S15, S13, S12, M27, T6, ST)

398-S. (French.) **Determination of Lead Compounds.** R. Collee. *Analytica Chimica Acta,* v. 14, no. 5, May 1956, p. 430-438.

Method for quantitative determination of various lead compounds present in ores and metallurgical products. (S11, Pb)

399-S. (German.) **Quality Prediction of Smelted Cast Iron and Steel by Optical Temperature Measurements.** Kurt Orths. *Archiv für das Eisenhüttenwesen,* v. 27, no. 5, May 1956, p. 289-295.

Application of radiation analysis, thermal analysis, effect of various physical aspects on solidification, overheating limits. (S16, N12, CI)

400-S. (German.) **Specifications for Materials in Gas Turbines.** Boris Haas. *Archiv für das Eisenhüttenwesen,* v. 27, no. 5, May 1956, p. 311-316.

Relationship between the efficiency and gas-intake temperature. Stress on turbine wheels. Effect of temperature changes. (S22)

401-S. (German.) **Operational Principles of Electrical Instruments for Surface Measurement and Inspection.** F. Seeboth. *VDI Zeitschrift,* v. 98, no. 16, June 1956, p. 869-874.

Two types of electric pickups transforming mechanical vibrations into electric oscillations: with the needle itself producing electric pressure, and with the needle modulating the amplitude of the high-frequency current supplied by a special oscillator. (S15)

402-S. (Italian.) **Internal Electrolysis by Means of a Circulating Anolyte. Determination of Cu, Pb, Cd and Fe in the Residual Alloy.** P. Ippoliti and A. Buratti. *Alluminio,* v. 25, no. 5, May 1956, p. 231-233.

Successful determinations carried out in presence of magnesium, silicon, titanium and aluminum.
(S11, Cu, Pb, Cd, Fe)

403-S. (Swedish.) **Records of Production and Defective Castings in Foundries.** *Gjuteriet,* v. 46, no. 5, May 1956, p. 65 + 6 pages.

Draft of a standard report form for production data and number and type of defectives was worked out from studies of forms from four different iron foundries.
(S12, S13, E general, CI)

404-S. (Swedish.) **Magnetic Powder Testing as an Inspection Method at the Steel Works for Rolled and Forged Products.** Klas Erik Johansson. *Jernkontorets Annaler,* v. 140, no. 4, 1956, p. 227-264.

Reliability of magnetic powder methods, attempts to find a rapidly working device, advantages of pulsating direct current for running control, description of new apparatus. (S13, F22, F23, ST)

405-S. (Swedish.) **Combustion Furnace With High-Frequency Heating for Carbon and Sulphur Determination.** B. Elgh, G. Ericson and A. Wiman. *Jernkontorets Annaler,* v. 140, no. 5, 1956, p. 373-385.

Material in lump form may be analyzed by use of high-frequency combustion furnace. Rapid testing is possible as the furnace is instantly available. (S11)

406-S. Anion-Exchange Studies. XXI. Th(IV) and U(IV) in Hydrochloric Acid. Separation of Thorium, Protactinium and Uranium. Kurt A. Kraus, George E. Moore and Frederick Nelson. *American Chemical Society, Journal,* v. 78, June 20, 1956, p. 2692-2694. (S11, Th, Pa, U)

407-S. Tracing Profits With Atoms. Annesta R. Gardner. *Dun's Review and Modern Industry,* v. 68, July 1956, p. 35-39, 82-84.

Radioactive atoms are solving a host of problems in a wide range of industries. Some examples are given. (S19)

408-S. Automation and Machine-Control Gauging. W. C. Mullin. *Electrical Engineering,* v. 75, July 1956, p. 611-614.

Methods of gaging, recent utilization in production for maximum benefit. (S14)

409-S. Studies of Non-Destructive Testing. II. Dye Penetrant Inspection. III. Electrified Particle Inspection. Susumu Yoshida and Kiyoshi Tamura. *Journal of Mechanical Laboratory (Japan),* v. 1, 1955, p. 18-19.

Some standard prescriptions for penetrants and developers. Atmospheric humidity was found to have an important effect on results of electrified particle inspection. (S13)

410-S. Liquid-Liquid Extraction Procedures in Inorganic Analysis. A Review of Practical Applications With Particular Reference to Metallurgical Analysis. T. S. West. *Metallurgia,* v. 53, no. 320, June 1956, p. 292-294.

Extraction of Group V metals. (S11)

411-S. Coulometric Determination of Uranium (VI) at Controlled Potential. Glenn L. Booman, Wayne B. Holbrook and James E. Rein. *Phillips Petroleum Co., Idaho Operations Office (U. S. Atomic Energy Commission),* IDO-14369, May 1956, 7 p.

Uranium (VI) is reduced to uranium (IV) at a controlled-potential mercury cathode using a potassium citrate-aluminum sulfate or a sulfuric acid electrolyte. The method can tolerate mercury (II), copper (II), iron (III), and large amounts of nitric acid. (S11, U)

412-S. (English.) **Studies on Ball-Bearing Steel. II. Effect of Some Metallurgical Factors on the Life of Ball Bearings. III. Austenitizing Behavior of Acid Open Hearth Furnace Steels, Basic Electric Arc Furnace Steels and SKF Ball Bearing Steels.** Manabu Ueno, Tetsutaro Mitsuhashi and Yutaka Nakana. *Journal of Mechanical Laboratory (Japan),* v. 1, 1955, p. 62-64.

Effect of chemical composition, nonmetallic inclusions, compressive load of inner ring, cementite content, grain size and degree of forging on life of ball bearings. Solubility of cementite in the two types of steels. (S21, N8, ST)

T

Applications of Metals in Equipment

162-T. Materials. *Aviation Age,* v. 25, June 1956, p. El + 21 pages.

Research and development trends, high-strength and temperature steels, new aluminum alloys, high-temperature chemicals, thermal limits of metals and nonmetals, product and data reviews. (T24)

163-T. Cast Beryllium-Copper Forging Dies. Clyde L. Frear. *Bureau of Ships Journal,* v. 2, June 1956, p. 6-8.

Molding practice, melting, economic and other advantages. Diagram, photographs. (T5, E general, Be, Cu)

164-T. Zirconium-Copper Raises Level of Commutator Performance. Webster Hodge and Paul W. Nippert. *Electrical Manufacturing,* v. 57, June 1956, p. 95-97, 354.

New alloy shows high conductivity, superior strength at elevated temperatures plus freedom from notch sensitivity and the ability to form and maintain a permanent commutation film. Tables, diagrams, photograph. 6 ref. (T1, Cu, Zr)

165-T. First Zirconium Vessel for HRT Reactor. G. E. Elder, E. C. Miller, L. F. Bledsoe and F. V. Daly. *Journal of Metals,* v. 8, May 1956, p. 648-650.

Hot forming of complicated shapes reduced number of welds. Project speeded by development of equipment and techniques to permit welding in the open. Diagrams, photographs. 6 ref. (T25, K general, Zr)

166-T. Aluminum Chain. H. F. Reid, Jr. *Materials & Methods,* v. 43, June 1956, p. 124-125.

Aluminum chain assemblies are particularly suitable in industries where corrosion resistant, nonsparking, nonmagnetic properties are required. Graph, table, photographs. (T7, Al)

167-T. Redesigning for Malleable Iron Castings. D. B. Fulton, J. R. Entenmann and T. J. Kirby. *Materials & Methods,* v. 43, June 1956, p. 140-142.

Case histories show how malleable can replace other materials where toughness or low cost are needed. Photographs, table. (T general, CI)

168-T. Applications of Investment Castings. *Metal Progress,* v. 69, June 1956, p. 132, 134, 136-138, 140, 142.

Digest of five papers covering improvements and economies, design factors, castability, quality control and inspection as they relate to fields of application. (T general, E15)

169-T. (German.) **Metallurgical Problems in Construction of Reactors.** *Zeitschrift für Metallkunde,* v. 47, no. 5, May 1956, p. 267-281.

Design and operation of the various structural elements of a reactor. Problems presented by the materials used, such as the fissionable material, construction material, moderator and reflector, cooling agent and control rods. Micrographs, photographs, tables, diagrams, graphs. 70 ref. (T25)

170-T. (Russian.) **Experimental Use of Cold-Rolled Electrotechnical Steel in Electric Machines.** D. V. Lokshin and Z. B. Neiman. *Elektrichestvo,* no. 5, May 1956, p. 46-50.

Advantages of cold rolled steels over high-alloy hot rolled steels for use in construction of electric machines. Best results are achieved when the direction of the magnetic flow is made to coincide with the direction in which the steel has been rolled. Diagrams, photograph, graphs. (T1, P16, ST)

171-T. Use of Zirconium in Liquid-Sodium Systems. F. E. Bowman and D. D. Cubicciotti. *A.I.Ch. E. Journal,* v. 2, June 1956, p. 173-176.

Attractive nuclear properties of zirconium make it a highly desirable core material for sodium-cooled reactors. Primary problem is control of oxygen, hydrogen and nitrogen impurities in sodium. (T25, Zr)

172-T. Chrysler Uses Up to 80 Lb. of Aluminum Per Car. *Automotive Industries,* v. 114, June 15, 1956, p. 70-71.

Tabular presentation of aluminum components in Chrysler automobiles. (T21, Al)

173-T. Tantalum Heat Exchangers and Haveg Tank Do the Job. Frank E. McElroy and Herbert H. Dorer. *Chemical Processing,* v. 19, July 1956, p. 52-55.

Reaction tank and steam heaters must withstand conditions of reaction with 32% hydrochloric acid at 75 to 80° C. (T29, Ta)

174-T. Highest Filtration Throughout Per Dollar of Investment. *Chemical Processing,* v. 19, July 1956, p. 70-71.

Stainless steel vertical pressure-leaf filter handles corrosive phosphoric acid with maximum operating economy. (T29, SS)

175-T. Steel Castings for Aircraft Challenge the Foundry Industry. Harold E. Simmons. *Foundry,* v. 84, July 1956, p. 88-90.

Some basic considerations for potential producers of aircraft quality castings. (T24, E general, CI)

176-T. Nuclear Industry Wants Better Steels. R. C. Dalzell. *Iron Age,* v. 177, June 21, 1956, p. 112-114.

Requirements for steels used by nuclear industries. (T25, ST)

177-T. More About Metal Honeycomb. J. D. Green, *Light Metals,* v. 19, June 1956, p. 186-187.

Application of aluminum honeycomb to aircraft. (T24, Al)

178-T. Titanium in Industry. L. J. Barron. *Modern Metals,* v. 12, June 1956, p. 35-36, 38.

Despite high cost, titanium's corrosion resistance makes it an economical material in many chemical and food processing applications. (T29, R general, Ti)

179-T. Tests Runs Start . . . Lightweight Trains Rolling. Kim Darby. *Modern Metals,* v. 12, June 1956, p. 50 + 5 pages.

Railroads are testing lightweight passenger trains that are much cheaper to buy and operate than conventional equipment. Much aluminum is used. (T3, Al)

180-T. Die Cast 6-Cylinder Engine Block. Alfred F. Bauer. *Modern Metals,* v. 12, June 1956, p. 72 + 6 pages.

Aluminum die cast block is cheaper to produce and machine and gives more efficient operation. It weighs 143 lb. less than iron. (T21, D13, Al)

181-T. Use and Properties of Extruded High-Strength Aluminum for Electric Bus Conductors. W. Switney and C. L. Carlson. *Power Apparatus and Systems,* no. 24, June 1956, p. 449-451; disc., p. 452-453.

Current-carrying tests on various sizes and configurations of bus bars made of new alloy give data for its application as a bus conductor for electric equipment. (T1, P15, Al)

182-T. Non-Defense Uses of Titanium Metal. L. J. Barron. *Steel Processing,* v. 42, June 1956, p. 333-335.

Strength-weight and corrosive service applications; economics of titanium use; applications in process industries; anodizing.
(T general, Q23, R general, J23, Ti)

183-T. Shipbuilding and the Steel Industry. A. Turner. *Steel Review,* nos. 3-6, Apr. 1956, p. 41-46.

Analysis of steel requirement trends. (T22, A4, ST)

184-T. Aluminum and Aluminum Alloys for Pressure Vessels. Marshall Holt. *Welding Journal,* v. 35, June 1956, p. 308S-312S.

Characteristics of materials available; design rules and problems; fabrication processes. (T25, Al)

185-T. Welded Inconel Salt Pot Increases Service Life, Slices Heat Treater Costs. H. W. Hiemke. *Western Metals,* v. 6, June 1956, p. 60-61.

Fabrication of salt pots which cost only .05 per hr. of operation.
(T5, K1, Ni-e)

186-T. Use of Castings in a Modern Iron and Steel Works. W. F. Cartwright. *Foundry Trade Journal,* v. 100, June 14, 1956, p. 443-450.

Mechanical properties of cast iron, factors influencing choice of material for a particular job, development of uses for nonferrous castings. (T5, E general, Q general, EG-a, CI)

187-T. Cast Steel Work Rolls in Hot Strip Mill Finishing Stands. F. H. Allison, Jr. *Iron and Steel Engineer,* v. 33, June 1956, p. 98-99.

Operating experience hints that accumulated heat and temperature are some basic factors leading to selection of steel over iron work rolls. (T5, F23, CI)

188-T. (French.) **Applications of the Napier "Deltic" Diesel Engine.** *Revue de l'Aluminium,* v. 33, no. 231, Apr. 1956, p. 371-378.

Characteristics and performance of the 18-cyl., 36-piston engine. Castings are of light alloys which lead to a very high-power weight ratio. (T21, EG-a)

V

Materials

General Coverage of Specific Materials

123-V. Properties of Zircaloy—2. D. E. Thomas and F. Forscher. *Journal of Metals,* v. 8, May 1956, p. 640-645.

A recent zirconium alloy with improved corrosion resistance and strength for atomic reactor construction. Photograph, micrographs, tables, graphs. 15 ref. (T25, Zr)

124-V. Experience With High-Manganese Stainless Steels. Richard E. Paret. *Metal Progress,* v. 69, June 1956, p. 68-71.

Newly standardized Types 201 and 202 should save much nickel, for they match most of the properties of 18-8 in sheet form. Changes in tooling are seldom necessary in the usual fabrication operations. Graph, tables, photographs. (SS)

125-V. Impurities in Titanium: Phosphorus. D. A. Sutcliffe. *Great Britain, Royal Aircraft Establishment Technical Note* MET.227, Sept. 1955, 10 p. + 1 plate.

Effect of phosphorus on properties of titanium. (Ti)

126-V. High-Flying Ti. S. R. Carpenter. *Western Machinery and Steel World,* v. 47, June 1956, p. 68-73.

The strength-weight properties of titanium, heat treat considerations, fatigue characteristics and some shop forming methods with reference to aircraft.
(Q23, Q7, G general, T24, J general, Ti)

127-V. Investigation of the Effects of Hot-Cold Work on the Properties of Molybdenum Alloys. *Climax Molybdenum Company, Progress Report for Wright Air Development Center Contract No. AF* 33(616)-2861, July to Sept. 1955, 18 p.

Interdependence of the degree of strain hardening, recrystallization temperature and mechanical properties of the Mo-0.3% Nb and Mo-0.5% Ti alloys. (Q general, Ti, Nb, Mo)

128-V. Investigation of Manufacturing Techniques for Titanium Alloy Sheet Material. *Ryan Aeronautical Company, Fourth and Fifth Progress Reports Nos. G-17-87 and G-17-88.* Contract No. AF 33(600)-31606, Apr. and May 1956, 39 and 35 p.

Reports on fusion welding testing resistance welding, heat treatment, tensile tests, embrittlement and scaling tests, and notch sensitivity tests. (K1, K3, J general, Q23, Ti)

129-V. Ti-22. Metal of the Future. M. G. Dobrolyubskaya. *Bureau for Translations, Canada. Translation No.* 15. 4 p. Directorate of Scientific Intelligence Defence Research Board, Ottawa, Canada. (From *Nauka i Zhizu'.* no. 11, 1955, p. 17-19).

Report on titanium industry and properties. (Ti)

130-V. (Czech.) **Antiremanent Fe-Si-Al Alloy "Sendust".** L. Duben. *Strojirenstvi,* v. 6, no. 2, Feb. 1956, p. 110-112.

Magnetic properties, including antiremanence. Method of casting, chemical compositon, heat treatment, uses in industry. Disadvantages include brittleness. (P16, E general, Q23, J general, T general, Si, Fe, Al)

131-V. (Czech.) **Properties and Treatment of Thermostat Bimetals.** J. Tykva. *Strojirenstvi,* v. 6, no. 2, Feb. 1956, p. 121-124.

Methods of determining physical and mechanical properties. Extreme delicacy of metals requires care in welding, machining and heat treatment. Effect of nickel content on coefficient of thermal expansion.
(SG-a, Cu, Ni, Fe)

132-V. (German.) **Boron in Heat Treatable and Case-Hardening Steels.** F. Erdmann-Jesnitzer and H. Kahle. *Neue Hütte,* v. 1, no. 6, May 1956, p. 322-332.

Influence of boron upon hardenability, properties of boron steels, metallurgical characteristics, theories of the boron effect.
(Q29, B. ST)

133-V. (German.) **The New High Capacity Hard Metal Quality S6HL.** C. Agte. *Neue Hütte,* v. 1, no. 6, May 1956, p. 333-338.

Composition, production and properties; cutting behavior and fields of application. (EG-d)

134-V. A Study of Ti-Al Alloys. II. The Effects of Addition of Ni on the Properties of Ti-Al Alloys. Susumu Yoshida and Takashi Araki. *Journal of Mechanical Laboratory (Japan),* v. 1, 1955, p. 35-36.

Effect of nickel on fabrication, hardness, strength and transformation temperature. (F general, G general, Q29, Ni, Al, Ti)

135-V. Some Aspects of Hardenable Alloy Steels. Herbert J. French. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, June 1956, p. 770-782.

Chemical composition significantly affects ductility and notch toughness of tempered martensites. Data suggest that mechanical properties of triple alloy nickel-chromium-molybdenum steels are superior to those of double or single alloy steels.
(Q general, AY)

136-V. Making 200-Type Stainless. G. W. Hinkle. *Steel,* v. 139, July 9, 1956, p. 94, 96.

Production characteristics and corrosion properties of the new low-nickel stainless grades. (SS, Ni)

137-V. (French.) **The Preparation of High-Purity Iron Monocrystals and Certain Properties of This Metal.** J. Talbot. *Institut de Recherches de la Siderugie, Publications,* ser. A, no. 137, Apr. 1956, 50 p.

Study of the preparation, analysis and polygonization of pure iron; mechanical properties. (Q general, Fe)

138-V. (Pamphlet.) **Literature Survey on the Production, Properties, and Uses of Zirconium.** F. J. Shortsleeve and R. L. Folkman. 31 p. 1953. Union Carbide and Carbon Research Laboratories, Niagara Falls, N. Y.

Extraction and production of metallic zirconium; properties of and potential use for zirconium and zirconium-base alloys; zirconium as a minor alloy addition. (V, Zr)

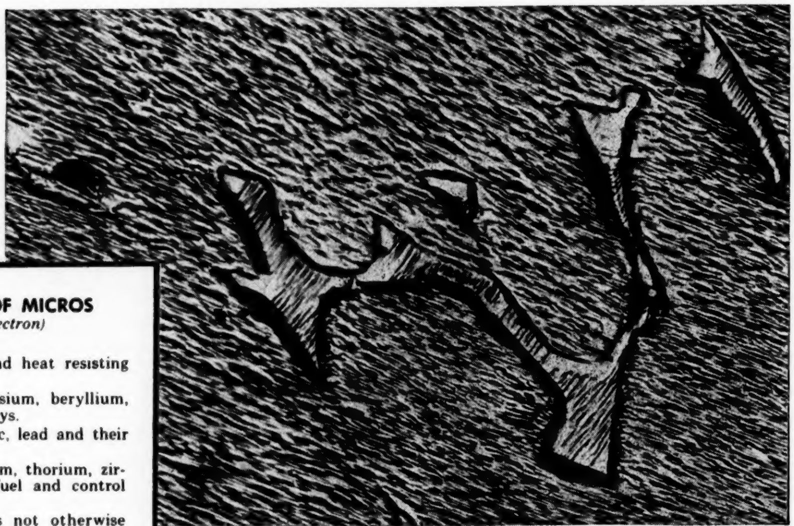
139-V. (Book.) **Zirconium—Technology and Economics.** Calvin Davis, Editor. 113 p. 1956. Atomic Industrial Forum, Inc., 260 Madison Avenue, New York 16, N. Y. $3.00.

A committee report on production, fabrication, properties, alloys, supply, commercial products and future requirements. (Zr)

140-V. (Book.) **Handbook of Welded Tubing.** 267 p. 1956. Formed Steel Tube Institute, Inc., 850-852 Hanna Bldg., Cleveland 15, Ohio. $20.00.

Advantages of tubing, types of tubing, mechanical properties and specifications, fabrication, typical applications, design data. (SS, CN)

11th Metallographic Exhibit



CLASSIFICATION OF MICROS
(Optical and Electron)

Class 1. Irons and steels.
Class 2. Stainless steels and heat resisting alloys.
Class 3. Aluminum, magnesium, beryllium, titanium and their alloys.
Class 4. Copper, nickel, zinc, lead and their alloys.
Class 5. Uranium, plutonium, thorium, zirconium and reactor fuel and control elements.
Class 6. Metals and alloys not otherwise classified.
Class 7. Series showing transitions or changes during processing.
Class 8. Welds and other joining methods.
Class 9. Surface coatings and surface phenomena.
Class 10. Results by unconventional techniques (other than electron micrographs)
Class 11. Slags, inclusions, refractories, cermets and aggregates
Class 12. Color prints in any of the above classes (no transparencies accepted)

Entries are invited in the 11th ASM Metallographic Exhibit, to be held at the National Metal Exposition in Cleveland, Oct. 6 through 12, 1956.

RULES FOR ENTRANTS

Work which has appeared in previous metallographic exhibits held by the American Society for Metals is unacceptable. Photographic prints should be mounted on stiff cardboard; maximum dimensions 14 by 18 in. (35 by 45 cm.) Heavy, solid frames are unacceptable. Entries should carry a label on the *face* of the mount giving:

Classification of entry
Material, etchant, magnification
Any special information as desired

The name, company affiliation and postal address of the exhibitor should be placed on the *back* of the mount.

Entrants living outside the U. S. A. should send their micrographs by first-class letter mail endorsed "Photo for Exhibition—May be opened for customs inspection".

Exhibits must be delivered before Oct. 1. 1956, either by prepaid express, registered parcel post or first-class letter mail, addressed to:

ASM Metallographic Exhibit
7301 Euclid Ave.
Cleveland 3, Ohio

AWARDS AND OTHER INFORMATION

A committee of judges will be appointed by the Metal Congress management which will award a First Prize (a medal and blue ribbon) to the best in each classification. Honorable Mentions will also be awarded (with appropriate medals) to other photographs which, in the opinion of the judges, closely approach the winner in excellence. A Grand Prize, in the form of an engrossed certificate and a money award of $100, will also be awarded the exhibitor whose work is judged best in the show, and his exhibit shall become the property of the American Society for Metals for preservation and display in the Society's national headquarters in Cleveland.

All photographs may be retained by the Society for one year and placed in a traveling exhibit to the various Chapters. They will be returned to the owners in May 1957 if so desired.

38TH NATIONAL METAL CONGRESS AND EXPOSITION

CLEVELAND, OHIO **OCTOBER 6 to 12, 1956**

EMPLOYMENT SERVICE BUREAU

The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A.S.M. Ads are limited to 50 words and only one insertion of any one ad. Address answers care of A.S.M., 7301 Euclid Ave., Cleveland 3, O., unless otherwise stated.

POSITIONS OPEN

East

SUPERINTENDENT—WELDING LABORATORY: $10,320 per year. U. S. Naval Engineering Experiment Station, Annapolis, Md., has opening for administrative and technical administration of welding laboratory concerned with applied research for the weldability of metals, development of welding procedures, welding materials, test procedure and suitability of weldments. Also serves as technical adviser and consultant to the Director of the Station, the Bureau of Ships and other laboratories. Applicants should have degree in metallurgical engineering and at least four years of progressively responsible experience in the general field, including at least one year very high level experience in welding engineering, metallizing and application of hard surface alloys. Application should be filed with the Industrial Relations Officer, U. S. Naval Engineering Experiment Station, Annapolis, Md., by Oct. 15, 1956.

STEEL FOUNDRY METALLURGIST: For foundry producing carbon, low alloy and high alloy steel castings. Excellent opportunity for qualified man. Location in Northeast. Box 8-25.

MANUFACTURERS AGENT: Wanted by well-known manufacturer of ferrous and nonferrous precision castings by the lost wax process. For New York City, vicinity and neighboring states. Box 8-30.

SALES ENGINEER: Sound knowledge of basic engineering and metallurgy and some foundry experience desirable. Permanent position with opportunity for advancement. Well-established company. Send complete resume and salary expected. Box 8-35.

METALLURGISTS: The Naval Air Material Center is engaged in an extensive program of aeronautical research, development, experimentation and test operations for the advancement of naval aviation. The Center needs metallurgists (salaries $5335 to $7035 per annum) for work on high-strength steels, precision castings, heat resisting alloys, oxidation resistant coating for molybdenum, inert and shielded metal arc and resistance welding. Positions include research, development and evaluation-type duties. Interested persons should file an Application for Federal Employment, Standard Form 57, with the Industrial Relations Dept., Naval Air Material Center, Naval Base, Philadelphia 12, Pa. Applications may be obtained from above address or any first or second class post office.

METALLURGICAL ENGINEER: Prominent Philadelphia growth company desires metallurgical engineer for responsible position with excellent future. Steel heat treating and carburizing experience preferred but not essential. Salary open. State training, experience, age and all other pertinent qualifications. Box 8-150.

JUNIOR METALLURGIST AND/OR METALLOGRAPHER: Recent graduate or night school student, wanted to assist in laboratory of growing, small company, pioneering in metallic coating processes for jet engine, nuclear reactor and commercial applications. Research and development person with mechanical aptitude preferred. U. S. citizenship required. Salary open. Westchester County, N. Y., location. Box 8-155.

Midwest

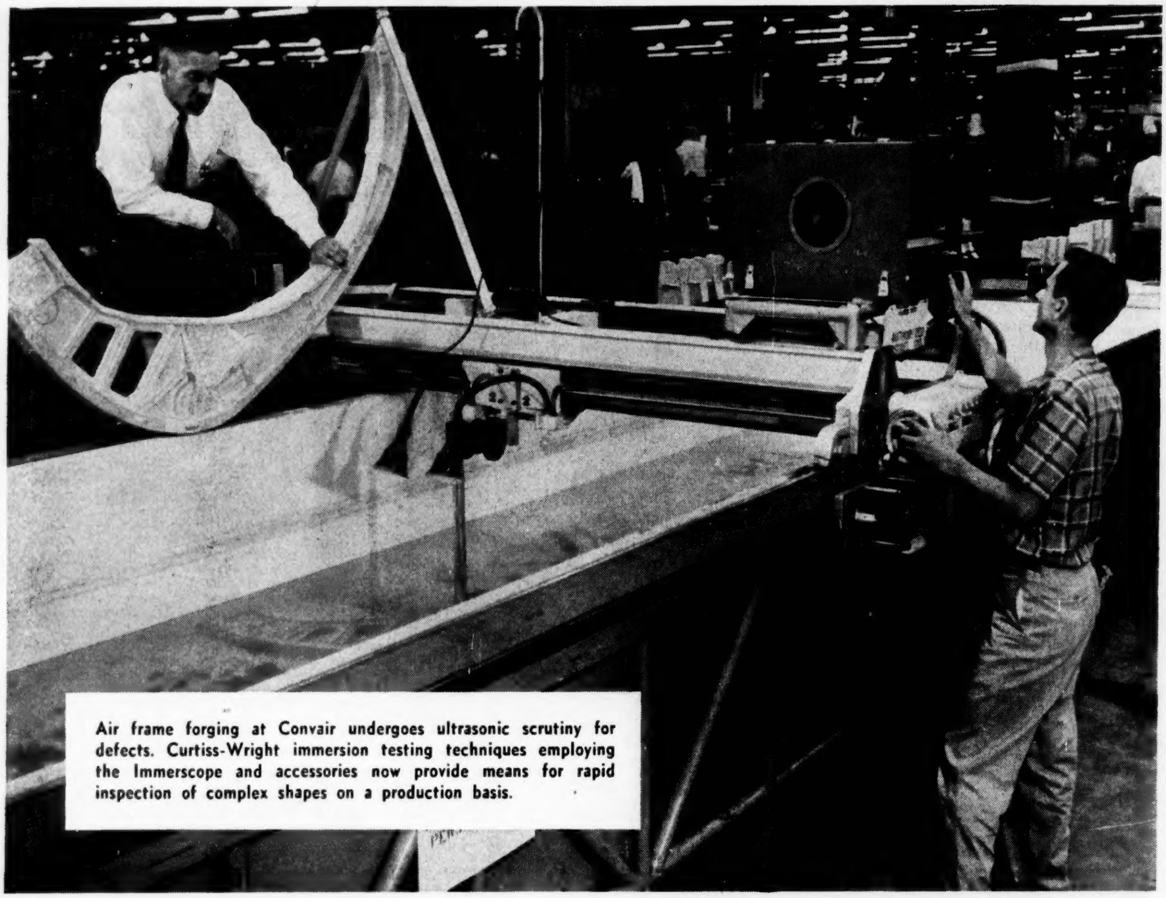
INSTRUCTOR OR ASSISTANT PROFESSOR: To teach courses in metallography and/or foundry engineering. Opportunity for graduate work. Salary and rank dependent upon qualifications. Write to: Dept. of Mining and Metallurgy, University of Wisconsin, Madison 6, Wis.

METALLURGIST: Recent graduate in metallurgical engineering for position in research division of progressive metalworking firm. Experience not necessary but will be given consideration. Applicant should be above average in intelligence, alert, and aggressive, with a desire to advance. Box 8-45.

RESEARCH METALLURGIST — CHEMIST: Exceptional career opportunity for research-minded metallurgist, chemist, or ceramist with B.S. or advanced degree, preferably with some research experience, to engage in studies on chemical and physical properties of inorganic coatings on metals in research laboratory of leading multiplant manufacturer of chemical processing equipment now in midst of expansion program, located in large city in upstate New York. Excellent salary and bonus. Send complete resume. Box 8-50.

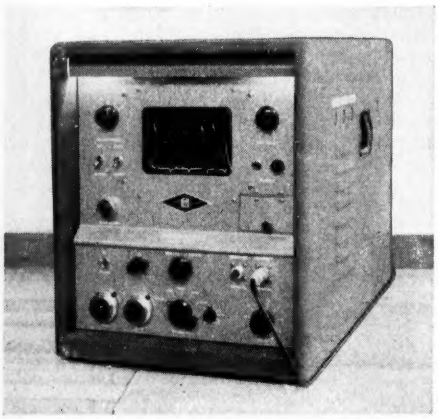
CHIEF METALLURGIST: Steelworking plant of well-known organization. Duties include supervision of laboratory and heat treat processing of various gears and shafts, consultation with other departments, and various shop problems in a plant of approximately 500 employees. Chief metallurgist reports directly to plant manager. Box 8-55.

RESEARCH SUPERVISOR: Metallurgist to perform and supervise research in field of high-temperature materials. Experience should be such that the man chosen could direct the efforts of a small research group. Areas of



Air frame forging at Convair undergoes ultrasonic scrutiny for defects. Curtiss-Wright immersion testing techniques employing the Immerscope and accessories now provide means for rapid inspection of complex shapes on a production basis.

Curtiss-Wright ULTRASONIC IMMERSCOPE Gives CONVAIR Forgings Final Exam for Quality



New Curtiss-Wright Immerscope (Model 424-A) protects quality of forgings, rolled plate, welded tubing, extrusions and other metal products. Complete with controls for gate width and depth, alarm trigger, and sensitivity time control. 400 w, 110-120 v, 60 cycle. 16"x15"x21½". Operates at 2.25, 5, 10, 15 and 25 megacycles.

Metal parts used by the aircraft industry are subjected to quality tests at all stages, from raw material to finished components. To insure *final* quality control at Convair-Fort Worth*, the Curtiss-Wright Ultrasonic Immerscope quickly detects flaws and discontinuities.

This ultrasonic detective "sees" through every square inch of the metal, with electrically induced sound vibrations up to several million cycles per second, revealing flaws as visible "pips" on a cathode ray tube.

The method is sure, fast and low in cost. Curtiss-Wright can engineer and custom-build production testing installations to your exact specifications. Write Industrial and Scientific Products Division, Curtiss-Wright Corporation, P. O. Box 270, Caldwell, N. J.

***Convair-Fort Worth, A Division of General Dynamics Corporation.**

INDUSTRIAL AND SCIENTIFIC PRODUCTS DIVISION

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research include: study and development of high-temperature alloys, studies of creep and relaxation, behavior of materials in corrosive environments, determination of properties and specification of materials for high-temperature use. Our company is a moderate-size, nonprofit research organization. The salary for this position will depend upon the man chosen, and probably will exceed $10,000. All replies will be treated as confidential. Box 8-160.

METALLURGIST: Large manufacturer of alloy cast steel rolls is looking for a young metallurgist for a position involving manufacturing control and product development. Send resume stating age, experience and salary desired to: E. P. Sandbach, Coordinating Metallurgist, United Engineering & Foundry Co., 948 Ft. Duquesne Blvd., Pittsburgh 22, Pa.

INDUSTRIAL SALES: Engineer for Ohio and Michigan. Applicant should be under 32 years of age, over 5 ft. 10 in., and have his own car. There will be a three-month training period, after which the engineer will be assigned a territory of approximately 200-mile radius, which will be a protected territory for his accounts. Salary, commission and expenses. Replies held confidential. Box 8-165.

West

METALLURGIST: Opportunity to live in quiet residential community noted for its pleasant climate and leisurely living. Ideally located just a short 50 minutes drive to the ocean, mountain and desert resorts. Permanent career opportunities with a progressive and expanding manufacturer of rolled and extruded aluminum products. Need man with approximately two years experience in nonferrous field to serve as process and control metallurgist. Box 8-40.

METALLURGISTS: With aptitude and interest in research or development in field of aluminum alloys, including fabrication. Good physical metallurgy background desired. Salary commensurate with qualifications. Reply to: Kaiser Aluminum and Chemical Corp., Dept. of Metallurgical Research, Physical Metallurgy Branch, Spokane 69, Wash.

South

INSTRUCTOR TO ASSOCIATE PROFESSOR: Academic position now open in metallurgical engineering. Location in pleasant Southern community. Position includes teaching undergraduate and graduate courses with opportunities for research. Prefer relatively young Ph.D. with interests in chemical metallurgy and thermodynamics. Salary and rank dependent upon qualifications. Send complete resume, including salary requirements. Box 8-170.

Metallurgist or Metallurgical Engineer

For field development work on use of alloys in electric steel melting and high-temperature alloys. B.S. degree, several years experience and moderate travel is required.

Box 8-15, Metals Review

METALLURGIST

Foundry, age 23 to 32. Opportunity to grow with expanding investment casting company. Metallurgist or engineer with metallurgical experience to develop gating and to maintain quality of aircraft castings. Foundry experience or experience with X-ray, Zyglo and high-temperature alloys desirable. Attractive salary and benefit program.

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POSITIONS WANTED

METALLURGICAL ENGINEER: Age 25, married, no children, B.S. degree. Presently serving two-year service in Army, to terminate at end of year. Experience includes two years of foundry techniques, melting and casting ferrous and high-temperature alloys. Has completed advance study in powder metallurgy. Two years service training in missiles and electronics. Desires work as sales engineer in Midwest, preferably Chicago area, but will consider attractive opportunities in high-temperature metal research. Box 8-60.

PHYSICAL METALLURGIST: M.Sc., Ph.D. degrees, age 30, Canadian. Four years diversified experience in research and development. Head of small metallurgical laboratory. Experience includes mechanical testing, heat treatment, metallography, materials specification, failure analysis, report writing and liaison contacts. About 10 publications. Has studied in U. S. and England. Desires position with greater opportunities for accomplishment. Prefers East. Box 8-65.

METALLURGICAL ENGINEER: B.S. degree, six years experience in industrial and aircraft metallurgy. Responsible supervisory positions. Laboratory operations, quality control of aircraft and automotive materials and processes, heat treating, plating, cold forming, ferrous and nonferrous materials, failure analysis, report writing and customer contact work. Resume on request. Prefers Michigan. Age 36, family, veteran. Box 8-70.

NONFERROUS METALLURGIST: Heavy 6063 aluminum extrusion and hard alloy experience. Superintendent of smelter, die casting process, designer, spectrographer, analytical chemist, Alumilite, heat treating. Background with leading aluminum window and building manufacturer. Age 47, married, three children. Available after one month's notice. Box 8-75.

METALLURGIST: B. of Met. E. degree, age 27, family. Two years experience as metallographer and materials engineer working with ferrous and nonferrous materials. Will complete three years active duty as Naval Ordnance specialist in November. Desires sales or production engineering position with opportunity for growth. Prefers California area. Box 8-80.

METALLURGICAL ENGINEER: Age 41, married, three children. B.S. degree, metallurgy major. Eighteen years metallurgical background in nuclear power, aircraft instruments, ferrous research, including extensive supervisory experience. Desires responsible position in engineering or quality control. Prefers East Coast. Minimum salary $12,000. Box 8-85.

METALLURGICAL ENGINEER: P.Eng., M.E.I.C., M.C.I.M.M. degrees. Canadian born, married, age 38. Graduate McGill University. Course in management administration. Twelve years diversified experience in ferrous metallurgy, including production, quality control and technical service in management capacity. Experience also in aluminum. Box 8-90.

RESEARCH METALLURGIST: Sc.D. degree, 25 years diversified experience in research, experimental, process development work, quality control and fabrication methods

in laboratories, steel mills and metal fabricating plants. Specialized in corrosion, wear, high-temperature resistant coatings, heat treatment, plastic forming and cold extrusion of ferrous and nonferrous metals and alloys. Director of research, experienced administrator, consultant and technical writer, intends to relocate. Box 8-95.

METALLURGICAL ENGINEER: B.S. degree, age 34, family. Eight years experience in heavy metals production using all types of electric furnaces. Familiar with all phases of management. Desires position utilizing background. Box 8-100.

MECHANICAL ENGINEER: M.S., Ph.D. degrees, age 33, single. Experience in metal processing and stress analysis with metallurgy, elasticity and plasticity as background. Experience includes seven years university teaching and academic research, four years research and consulting in industry. Interested in top-level industrial research or senior university teaching position. Presently technical assistant to chief engineer of large company. Box 8-105.

HEAT TREAT SPECIALIST: With 35 years experience in all forms of carburizing and hardening parts for precision production. Capable of developing procedures for new production. Qualified to operate all types of carburizing furnaces, all types of hardening furnaces and machines. Presently in charge of heat treating department. Desires position on full or part-time basis in Los Angeles area. Age 68, health good. Box 8-110.

METALLURGICAL ENGINEER: B.S. degree, age 33, married, family. Eleven years diversified experience in technical control and fabrication of aluminum. Presently employed with original employer, desires change to smaller and more intimate organization with aim to develop into executive position and away from direct engineering, preferably utilizing aluminum background, but not essential. Location East or South. Salary from $12,000 to $15,000. Box 8-115.

METALLURGICAL ENGINEER: B.S. degree, family, age 27, discharge from Army in August. Two years experience in engineering division of large automobile manufacturer. Main interests in casting industry. Varied foundry experience. Desires position in Washington or Oregon. Box 8-120.

METALLURGIST: Qualified British metallurgist (British degree), age 28, single, with seven years experience in production and applied research, now in U.S.A. on fellowship studying business administration and the American metals industry. On completition of masters degree, in August, seeks responsible position with American organization either in U. S. or Europe in production metallurgy or technical sales. Box 8-125.

FOREMAN: Supervising, experienced in melting and pouring alloys, with present connection 14 years, seven years as assistant to company president. Seeks improved responsible position with progressive, expanding concern to enlarge field of interest. Married, family, age 38. East preferred but will consider relocation. Box 8-130.

METALLURGICAL ENGINEER: M.S. degree, married. Fifteen years supervisory experience in metallurgical development programs, including metal fabrication, vacuum melting and casting, powder metallurgy and ceramics. Long experience in nuclear energy field with materials for reactor construction. Desires responsible and challenging supervisory position. Q cleared. Box 8-135.

MECHANICAL ENGINEER: Graduate, member A.S.M. and A.S.M.E., age 71 but active. Experienced as machinist, general shop foreman, shop superintendent, draftsman, designer, testing materials, research engineer. Wants supervisory work improving present products and developing new ones. Married. Licensed engineer. Address: Edward Skillman, Enterprise, Kan.

MANUFACTURERS REPRESENTATIVE: Experienced metallurgist wishes a manufacturer's representativeship in metal trade to augment own consulting business. Midwest preferred, will travel. Box 8-140.

METALLURGICAL ENGINEER: Age 28, M.S. in metallurgy, A.B. in chemistry, married, no children. Over five years diversified experience in aircraft industry, including engineering liaison, material and process specifications and plant trouble shooting. Desires responsible position with advancement potential. Box 8-175.

CHIEF METALLURGIST: B.Sc.Eng. (Met.) London university. Age 29, ten years diversified experience in high-frequency melting, hot and cold rolling and heat treatment of grain oriented silicon iron, nickel-iron and chromium iron alloys. At present in charge of modern shell molding steel foundry and quality control laboratory in United Kingdom. Desires position in foundry, steel processing, continuous casting of steel, technical salesman for steel mill equipment. Available immediately. Box 8-180.

CHIEF METALLURGIST AND LABORATORY MANAGER: In factory manufacturing wrought aluminum alloys for aircraft application. M.Sc. degree, Dipl.Eng., member of several professional societies. Age 35, married, 8½ years practical experience in engineering, steel, copper and aluminum. Desires position in metallurgy utilizing engineering background and administrative, organizing and staff control abilities. Several languages. Capable producing results. Location not important. Box 8-185.

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